

Electronics & Technology Today

\$3.50
MM70924
JULY 89

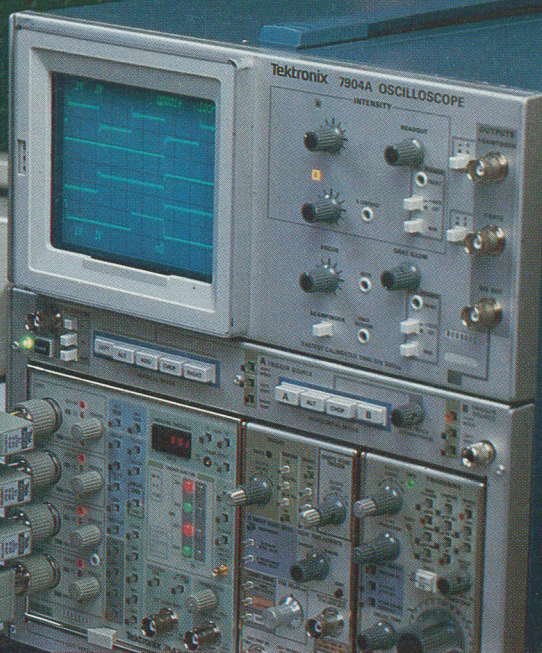
Canada's Magazine for High-Tech Discovery

Test and Measurement

New gear for the testbench

PLUS

Audioprism Antenna
Metal Detector Project
A/D Interface



RCA
Camcorder



513735*JAN 90* ET03* *
KEVIN JOURNEAUX
68 EASTON AVE
MONTREAL WEST PQ H4X 1K8

**VISIT OUR
SHOWROOM AT
321 COLLEGE ST., TORONTO**

THE BEST

Designed and Made in

BEST COMPACT 386SX

This newest addition to our computer line features the Intel 80386 SX 16 MHz microprocessor which uses a 16 bit external bus similar to the 286 AT compatible machines. However internally the 32 Bit 386-SX microprocessor is compatible with that of a 80386 processor. Socketed for optional 80387SX co-processor. Features 1 MB onboard RAM (optionally expandable onboard to 2MB and 4 MB RAM). Processor speed 16 MHz (switchable to 8 MHz), 8 expansion slots, Two serial ports, one parallel port, real time clock, one 1.2 MB floppy disk drive (optionally available with 5.25" 360K or 720K 3.5" floppy disk drive), 101 enhanced keyboard. Features a small footprint, yet it can take as many cards and drives (including hard drives) as full-sized models.

Since this machine has such extraordinary performance at such a low price, we believe it represents the best value in the market today.

BEST COMPACT 386-16

(16 MHz, 8-slot 386 System)

Based on the Intel 80386 microprocessor, Phoenix BIOS, One 1.2MB Floppy Diskette Drive (Optional 360K 5.25" Floppy Drive or 720K 3.5" Floppy Drive or 1.44MB 3.5" Floppy Drive), socketed for 80387 math co-processor, 8 Expansion Slots, Two Serial Ports, One Parallel Port, Real Time Clock, Floppy Controller and Hard Drive Controller, 101 Enhanced Keyboard. Available with 32-bit memory in the following RAM configurations: 2 Mb, 4MB, 8 MB, 16 MB. Features a small footprint, yet it can take as many cards and drives (including hard drives) as full-sized models.

Also available
COMPACT 386-20
a 20MHz version
of the above configuration.

BEST PERFORMER 86 10-3

(10 MHz, 3-slot XT Compatible)

Based on the 16-Bit 10MHz 8086 microprocessor, Phoenix BIOS, Available with one 360K 5.25" Floppy or up to two 720K 3.5" Floppy Diskette Drive, socketed for 8087 math co-processor, 640K RAM, 3 Full-Length XT Expansion Slots, Two Serial Ports, One Parallel Port, Real Time Clock, Also features On-Board Hercules Compatible Display Adapter, Floppy Controller and SCSI Hard Drive controller, key lock for system and case, 101 Enhanced Keyboard.

Optional extras include 20 MB SCSI Hard Drive or 40MB SCSI Hard Drive.



WARF
All Exceltronix **BEST** c
One Year Warranty a

Exceltronix

BEST RANGE

in Canada with Pride

BEST PERFORMER 286/12-3

(12 MHz, 3-slots AT Compatible)

Based on the Intel 80286 microprocessor, Phoenix BIOS, One 1.2MB Floppy Diskette Drive (Optionally, use up to two 3.5" 720K or 3.5" 1.44MB Floppy Drives in place of the 1.2 MB Drive), socketed for 80287 math co-processor, 640K RAM (Optionally expandable to 1 MB onboard or higher using 16-Bit memory expansion cards), 3 Full-Length Expansion Slots, Two Serial Ports, One Parallel Port, Real Time Clock, Floppy Controller and a Connors Hard Drive Controller, key lock for system and case, 101 Enhanced Keyboard.

BEST COMPACT 286-16

(16 MHz, 8-slot AT Compatible)

Based on the Intel 80286 microprocessor, Phoenix BIOS, One 1.2MB Floppy Diskette Drive (Optional 360K 5.25" Floppy Drive or 720K 3.5" Floppy Drive or 1.44MB 3.5" Floppy Drive), socketed for 80287 math co-processor, 640K RAM (Optionally expandable to 1 MB onboard or higher using 16-Bit memory expansion cards), 8 Expansion Slots, Two Serial Ports, One Parallel Port, Real Time Clock, Floppy Controller and Hard Drive Controller, 101 Enhanced Keyboard.

Other BEST Compact 286 Models (which incorporate the above standard features) are:

COMPACT 286-8: Runs at 8MHz

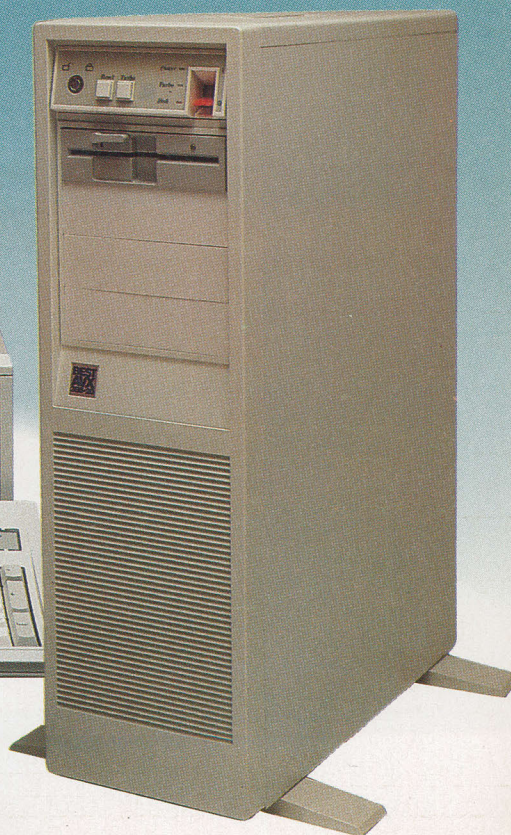
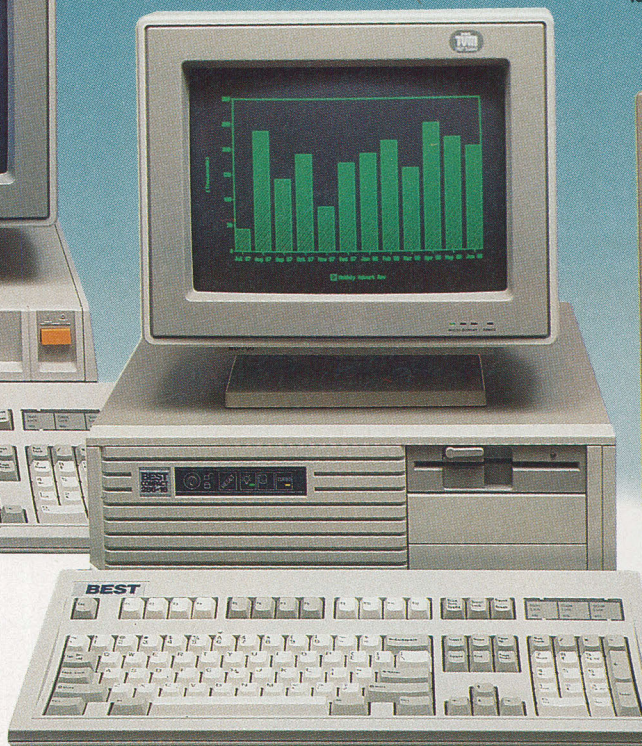
COMPACT 286-10: Runs at 10MHz

COMPACT 286-12: Runs at 12MHz

BEST AVX 386-20

(20 MHz, 8-slot 386 System)

Super performance in an attractive, practical tower case. Based on the Intel 80386 microprocessor, Phoenix BIOS, One 1.2MB Floppy Diskette Drive (Optional 360K 5.25" Floppy Drive or 720K 3.5" Floppy Drive or 1.44MB 3.5" Floppy Drive), socketed for 80387 math co-processor, 8 Expansion Slots, Two Serial Ports, One Parallel Port, Real Time Clock, Floppy Controller and Hard Drive Controller, 230W Power Supply, 101 Enhanced Keyboard. Available with 32-bit memory in the following RAM configurations: 2 Mb, 4MB, 8 MB, 16 MB. The tower case has the advantage of plenty of room for practically any combination of floppy and hard drives. Plus a total of 8 expansion cards! Ideal for use as a file server.



WARRANTY

Computers come with a full
and are CSA approved.

321 College Street, Toronto
433 Horner Avenue, Unit 12, Etobicoke, M8W 4Y4 (416) 252-8543 FAX (416) 252-5124
360 Albert Street, Suite 1510 Ottawa, K1R 7X7 (613) 235-2378 FAX (613) 235-2416
Halifax: (902) 454-0052 Edmonton: (403) 483-4271 Montreal: (514) 849-5872

Some great minds contemplate the stars.



We create them.

Meet the Toshiba T8500. In every way, as a LAN server, Unix platform, or both, it's a stellar achievement that provides outstanding performance. It has the ability to become the centre of your expanding office computing universe.

It can add new dimensions of power, flexibility, speed and storage without having to change your system. It will become the hub around which other desktops and portables in your world revolve. Not only that, but it's striking to look at and very compact.

The T8500 also has several other bright points to separate it in a galaxy of others.

- 64KB cache memory integrated with 80386 processor (25MHZ)
- State-of-the-art technology which integrates many functions on a unique "mother board"



design, encompassing standard SCSI interface port, 2 serial ports and VGA port

- A standard built-in, fast, 100 MB hard disk drive, with the option of a second one or a 150MB tape back-up unit
- Significant auxiliary disk storage options are also available through the standard SCSI port
- Increased raw memory capacity with Toshiba's world renowned DRAM chip technology (2MB standard)
- Standard protocols which allow interface with existing well-known LAN software
- Supports multiple operating systems: MS-DOS, OS/2 and/or Unix V.

The best continue getting better.

To get one of these brilliant systems in your office, contact your nearest Toshiba re-seller. Or call Toshiba direct 1-800-387-5645.

TOSHIBA
WE MEAN BUSINESS
INFORMATION SYSTEMS DIVISION

Circle No. 2 on Reader Service Card

Electronics & Technology Today

Electronics & Technology Today
is published 12 times a year by:
Moorshead Publications Ltd.
1300 Don Mills Road, North York, Ontario
M3B 3M8 (416)445-5600 FAX: (416)445-8149

Editor:	William Markwick
Director of Production:	Papu Leynes
Art Direction:	Kevan Buss
Circulation Manager:	Sharon Cernecca
Advertising Representative:	Richard Maharaj
President:	H.W. Moorshead
Publisher & Executive Vice-President:	V.K. Marskell
Vice-President—Sales:	A. Wheeler
Vice-President—Finance:	B. Shankman
Production Assistants:	C. Dalziel N. Sunderji
Office Manager:	P. Dunphy
Reader Services:	R. Cree J. Cardoni
Advertising Services:	M. Millett H. Brooks

Newsstand Distribution:
Master Media, Oakville, Ontario

Subscriptions:
\$22.95 (one year), \$37.95 (two years).
Please specify if subscription is new or a renewal.

Outside Canada (US Dollars). U.S.A. add \$3.00 per year. Other countries add \$5.00 per year.

Electronics & Technology Today
is indexed in the Canadian Magazine Index
by Micromedia Ltd.

Back copies are available in microfilm form
from Micromedia Ltd. 158 Pearl Street,
Toronto, Ontario M5H 1L3 (416)593-5211.

Printed by:
Heritage Press Ltd., Mississauga, Ontario

ISSN 07038984

Moorshead Publications also publishes PETS
Magazine, Computing Now!, Computers in
Education, Business Computer News and
Government Purchasing Guide.

Circulation independently audited by
MURPHY & MURPHY Chartered
Accountants.

Postal Information:
Second Class Mail Registration No. 3955.
Mailing address for subscription orders,
undeliverable copies and change of address
notice is:
Electronics & Technology Today
1300 Don Mills Road, North York, Ontario
M3B 3M8.

Electronics & Technology Today

Canada's Magazine for High-Tech Discovery

Volume 14, Number 6

July 1989

FEATURES

- Test and Measurement**6
Our annual collection of new test gear.
- Interfacing the PC, Part 7** 46
Steve Rimmer continues on...
- Techie's Guide to C, Part 7**50
...and on, with the subtleties of C.
- AutoCAD for Electronics, Part 3**56
In which we actually begin to draw.

TECHNOLOGY

- The AudioPrism Antenna**54
Improve your FM reception.

PRODUCT REVIEW

- Ontrak Data Acquisition**14
Low cost data via RS232
- RCA Camcorder**18
Shoot, edit and title right from the camera.

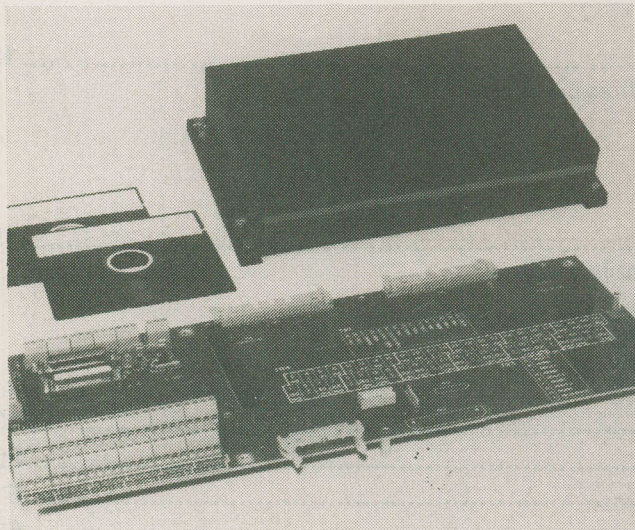
PROJECTS

- Metal Detector**15
Finding wires, pipes and nails in walls.

INFORMATION

- Toshiba Winner**13
- Marketplace**20
- Next Month**51
- Ad Index**60

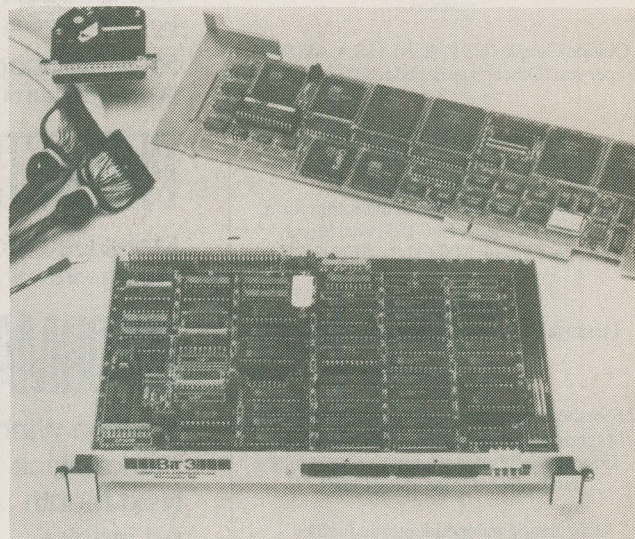
Test and Measurement



I/O Scanner

The Model RWM1000 I/O scanner has 32 programmable analog inputs, 4 analog outputs and 32 digital I/O lines. It features 32 single-ended or 16 differential input channels, 12 or 14 bit resolution, and two serial ports for communication with the host computer and one remote. Industrial Computer Source, 4837 Mercury St., San Diego, California 92111, (619) 279-0084, Fax 541-1138.

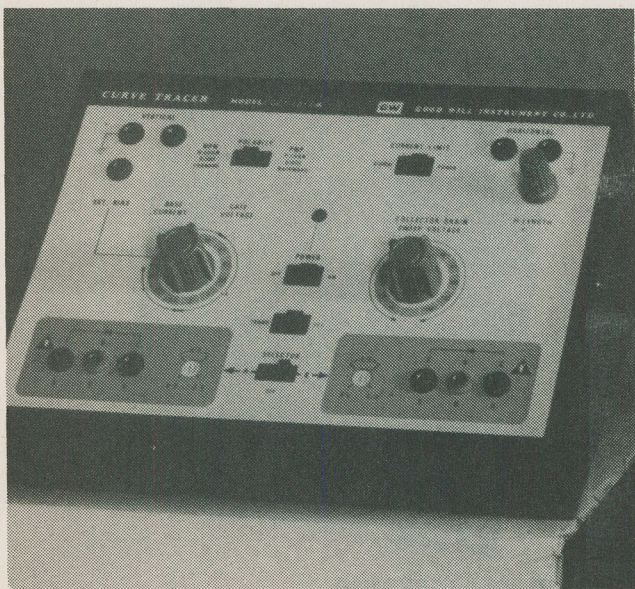
Circle No. 3 on Reader Service Card



IBM to VME Interface

The Bit Model 443 adaptor enables an IBM PS-2 to be a master bus processor or coprocessor on a VMEbus. Up to 16 Mbytes of VME memory can appear as PS-2 memory, and VMEbus I/O can be directly accessed by the PS-2. The system consists of a card for the PS-2 and one for the VME. Bit 3 Computer Corp., 8120 Penn Avenue S., Minneapolis, Minnesota 55431-1393, (612) 881-6955, Fax 881-9674.

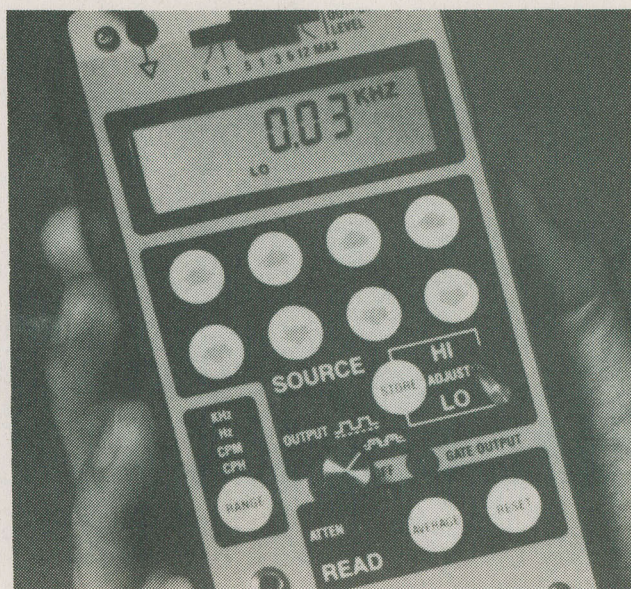
Circle No. 4 on Reader Service Card



Low-cost Curve Tracer

The GCT1212A Curve Tracer from GW Instruments provides cost-effective tracing of transistors, FETs, SCR's, triacs, zeners and rectifier diodes with virtually any oscilloscope. Collector voltage can be swept up to 150V. Duncan Instruments, 121 Milvan Drive, Toronto, Ontario M9L 1Z8, (416) 742-4448.

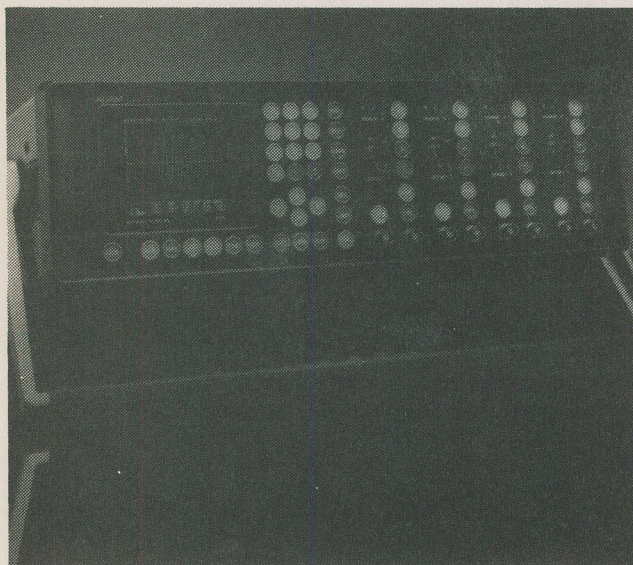
Circle No. 5 on Reader Service Card



Frequency Calibrator

The Beta frequency calibrator is a 4 1/2 digit frequency source measuring from 0.1Hz to 199.99kHz with resolution down to 0.1Hz. A single 9V battery allows 50 hours of field use. The output is adjustable from millivolts to 12Vp-p. Beta Products, 2029 McKenzie Drive #150, PO Box 115004, Carrollton, Texas 75011-5004, (214) 241-2200.

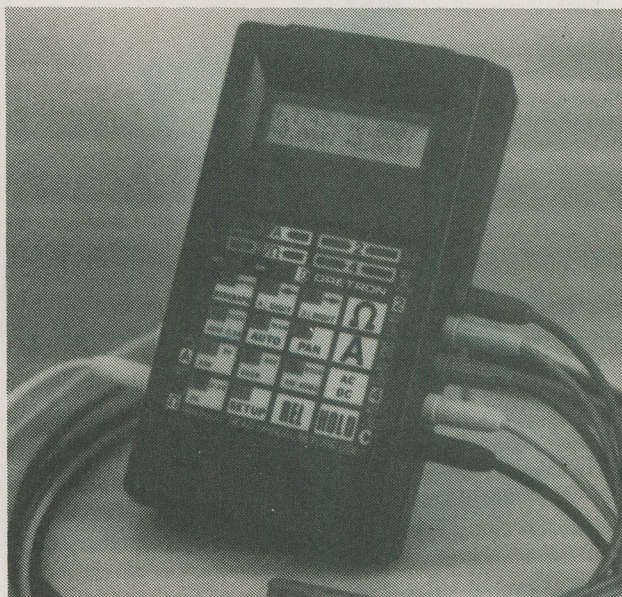
Circle No. 7 on Reader Service Card



Transient Recorder

The Adam is a portable, two to twelve channel waveform recorder. The user can capture and analyze data with the resident software; an optional IBM PC/AT controller allows the Adam to perform sophisticated signal analysis. Omnitronix Ltd., #4-2410 Dunwin Drive, Mississauga, Ontario L5L 1J9, (416) 828-6221, Fax 828-6408.

Circle No. 6 on Reader Service Card

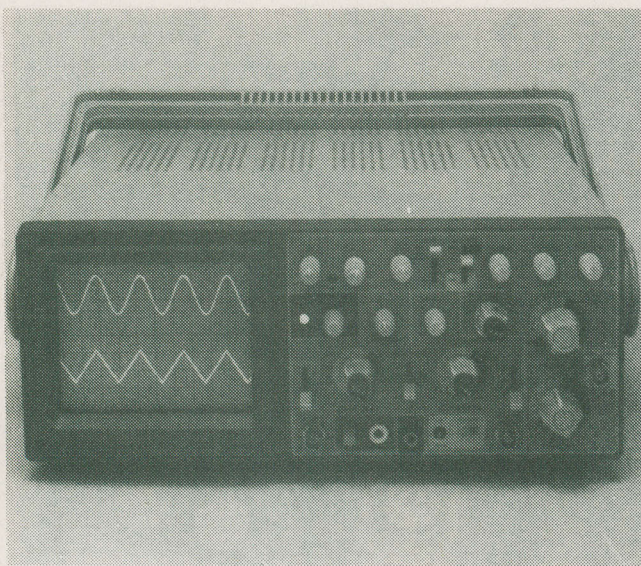


Component Analyzer

The Daetron MC400 analyzer can identify most three-pinned semiconductors, low-voltage regulators, rectifiers, capacitors, cable lengths, etc. It features autoranging and an accuracy of 0.5% with a full 4-digit LCD display. Daetron, Mississauga, Ontario, (416) 676-1600.

Circle No. 8 on Reader Service Card

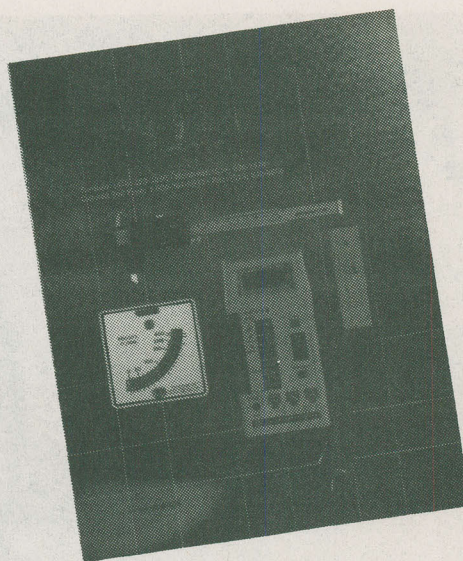
Test and Measurement



20MHz Scope

The Metermaster Model MM-200 oscilloscope features a bandwidth of DC to 20MHz, dual channels, 1mV/div sensitivity and a minimum sweep time of 10ns/div. The MM-200 is one of a family of scopes which include 40 and 60MHz units. Metermaster division of R.H. Nichols, 80 Vinyl Court, Woodbridge, Ontario L4L 4A3, (416) 851-6862, Fax 851-6862.

Circle No. 9 on Reader Service Card



Instrument Catalogue

Catalogue 189 from ITM Instruments includes hard-to-find units, such as air velocity and pressure gauges, temperature and humidity devices, laboratory instruments, gas detection meters, etc., as well as a full range of electrical meters. ITM Instruments, 5715 Kennedy Road, Mississauga, Ontario, L4Z 2G4, (416) 283-3058, or Montreal (514) 636-1574. Toll-free in Canada is 1-(800)-361-6042.

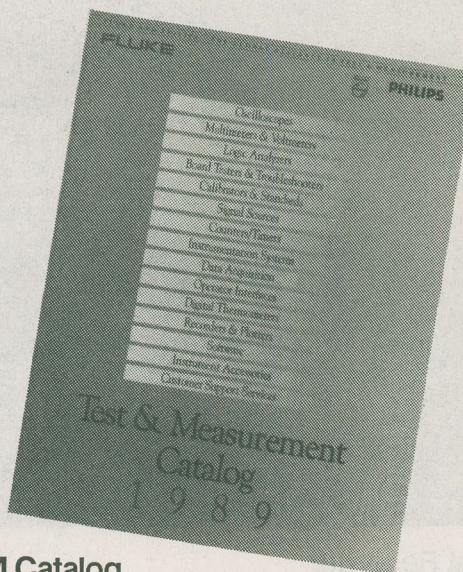
Circle No. 11 on Reader Service Card



Temperature Logger

The Temptimem temperature data logger can monitor from -20°C to +60°C with sampling rates adjustable from one minute to two hours. It can measure for up to 1020 days and has an RS232 output for plotting of statistical graphs. RCC Electronics, 310 Judson St., Unit 19, Toronto, Ontario M8Z 5T6, (416) 252-5094, FAX 252-3031.

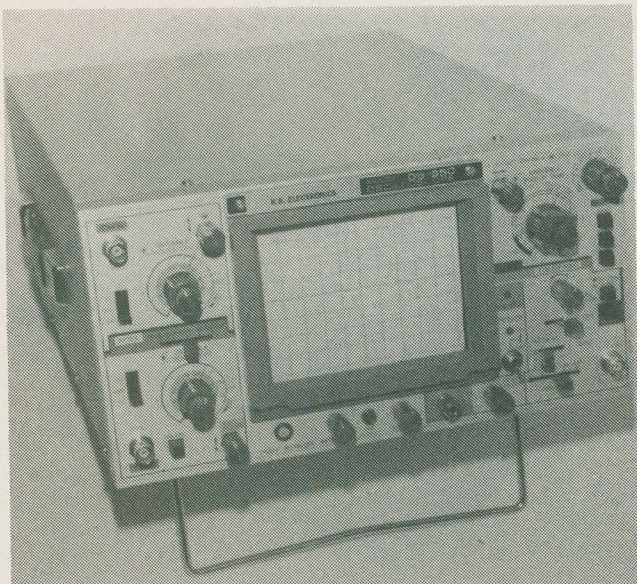
Circle No. 10 on Reader Service Card



T&M Catalog

The 504-page Fluke catalogue includes oscilloscopes, multimeters, logic analyzers, board testers, calibrators, signal sources, counters, data acquisition and much more. Fluke Electronics Canada, 400 Britannia Rd. E., Unit 1, Mississauga, Ontario L4Z 1X9 Tel: (416) 890-7600, Fax: (416) 890-6866

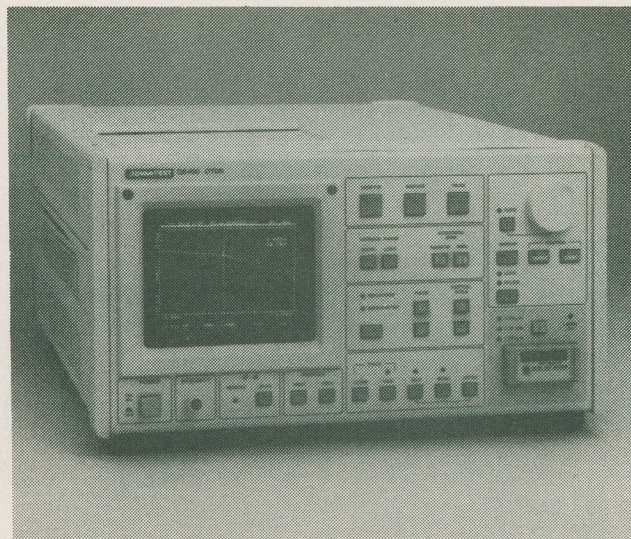
Circle No. 12 on Reader Service Card



50MHz Bench Scope

The OS-650 Dual Trace Oscilloscope features 50MHz bandwidth with 17KV accelerating potential, a rise time of 7.7ns and a sensitivity of 1mV/div. A delayed triggered sweep is available on any point on the waveform. KB Electronics, 355 Iroquois Shore Road, Oakville, Ontario (416) 842-6888.

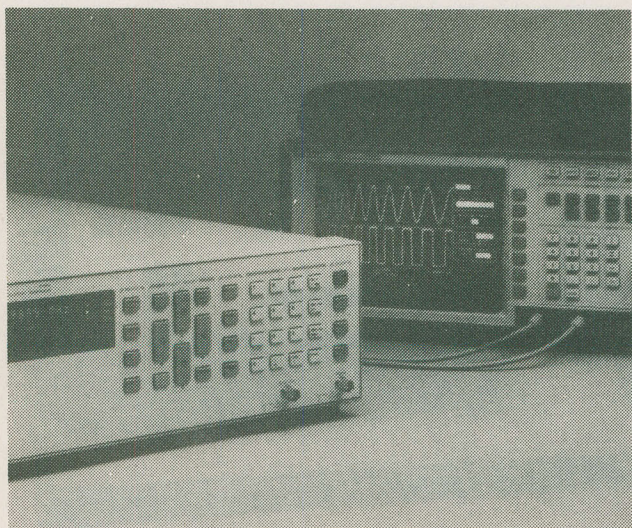
Circle No. 13 on Reader Service Card



Optical Test Sets

Advantest announces the release of three new optical test sets, the TQ8450A Time Domain Reflectometer for use up to 128km, the Q8460 for 15 and 50km, and the Q8381 Optical Spectrum Analyzer. CRTs and waveform memories or printers are used to display data. Allan Crawford Associates, 5835 Coopers Ave., Mississauga, Ontario L4Z 1Y2, (416) 890-2010, Fax 890-1959.

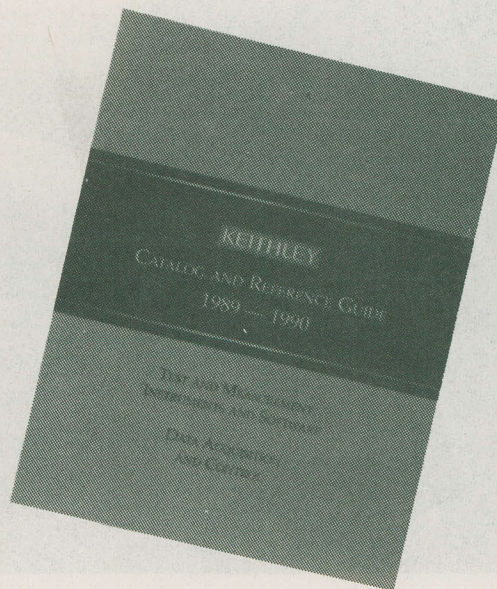
Circle No. 15 on Reader Service Card



Frequency Synthesizer

The HP 3324A synthesized function/sweep generator is designed to provide lower-priced performance than comparable generators. It provides sine, square, triangle and ramps over the 1MHz to 21MHz range. The 9-digit display allows extra-low resolution. Hewlett-Packard Canada Ltd., 6877 Goreway Drive, Mississauga, Ontario L4V 1M8, (416) 678-9430.

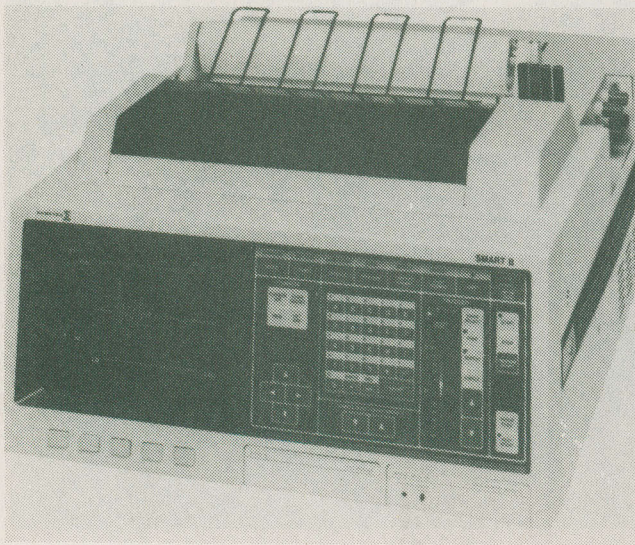
Circle No. 14 on Reader Service Card



T&M Reference Guide

The Keithley 250-page guide to test and measurement is available without charge and includes tutorials on instrumentation, data acquisition, PC software, interfacing and much more. Keithley Instruments, 28775 Aurora Road, Cleveland, Ohio, (216) 248-0400.

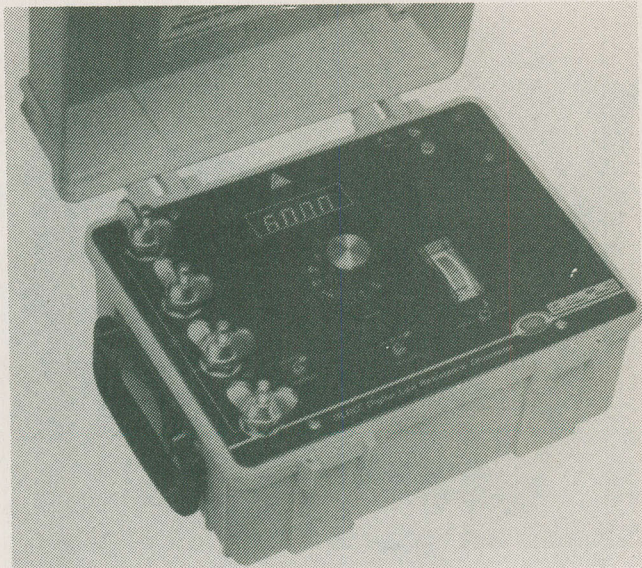
Test and Measurement



Transient Recorder

The Smart IIA captures, analyzes, displays and plots signals from a variety of sensors and can be used for package drop testing, low level environmental shock, vibration analysis, etc. Two channels are standard and can be expanded to four. Endeeco, 30700 Rancho Viejo Road, San Juan Capistrano, California 92675, (714) 493-8181.

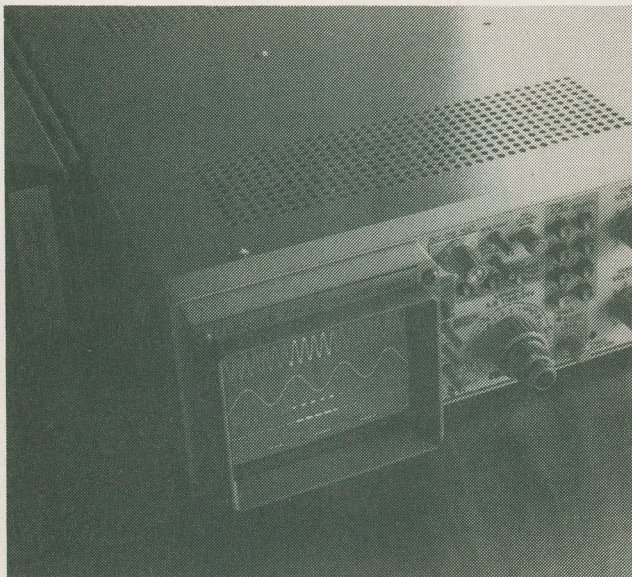
Circle No. 16 on Reader Service Card



Low Resistance Meter

The Digital Low Resistance Ohmmeter from Biddle makes simple, 4-terminal low resistance measurements from 0.1 micro-ohm to 60 ohms with accuracies of 0.25%. The unit is fully portable, with rechargeable batteries. Biddle Instruments, Blue Bell, Pennsylvania 19422, (215) 646-9200, Fax 643-2670.

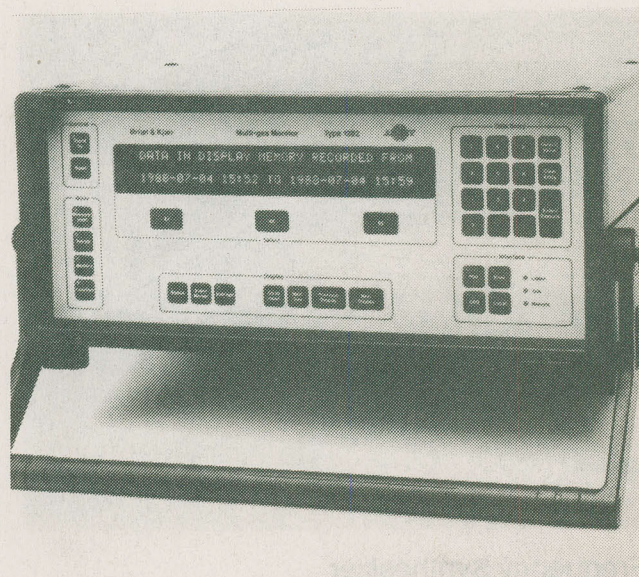
Circle No. 18 on Reader Service Card



Portable Scopes

The Leader models LBO- 313, 314 and 315 are portable scopes with bandwidths of 20, 40 and 60MHz respectively. They're compact, battery-powered and feature comprehensive horizontal amplifier sections. Omnitronix Ltd., #4-2410 Dunwin Drive, Mississauga, Ontario L5L 1J9, (416) 828-6221, Fax 828-6408.

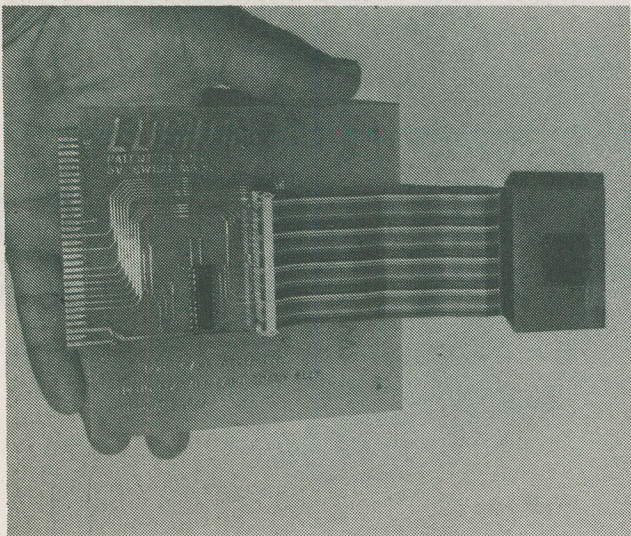
Circle No. 17 on Reader Service Card



Gas Monitor

The Multigas Monitor Type 1302 provides comprehensive protection from many potentially dangerous gases. It uses photo-acoustic technology in a ring of monitors to identify the nature and source of emissions. Bruel and Kjaer Canada Ltd., 90 Leacock Road, Montreal, Quebec H9R 1H1, (514) 695-8225.

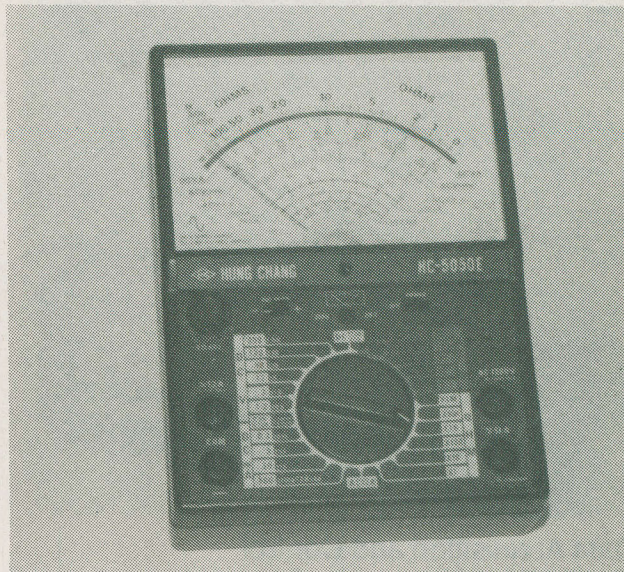
Circle No. 19 on Reader Service Card



PC Tester

The Logimer is a plug-in tester for troubleshooting the IBM PC/AT and compatibles. It performs 1,000 tests and checks every part of the motherboard, video, keyboard, controllers, etc. If the monitor is not working, charts are used to interpret the LED reading. Barjus Universal, 6012 Yonge St., Willowdale, Ontario M2M 3V9, (416) 661-6181, Fax 733-3749.

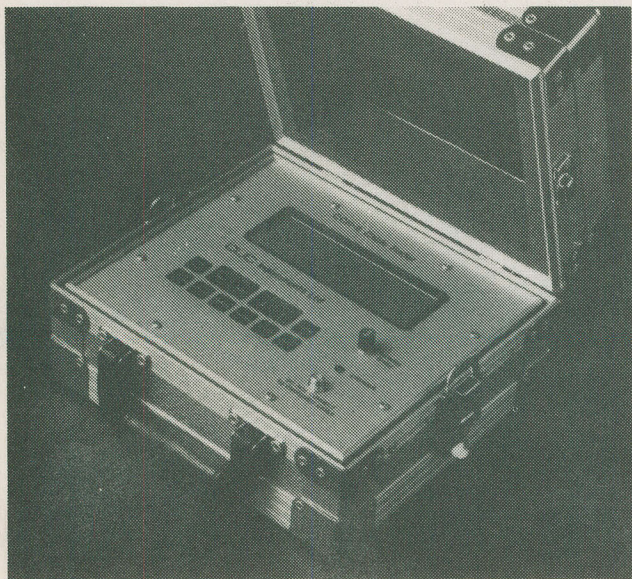
Circle No. 20 on Reader Service Card



Analog Multimeter

Still an economical alternative to the DMM, HC 5050E analog multimeter has 43 ranges, AC/DC volts and amps, resistance to 1000M, and a basic accuracy of $\pm 2.5\%$. KB Electronics, 1428 Speers Rd., Unit 8, Oakville, Ontario L6L 5M1, (416) 847-5488, Fax 847-8598.

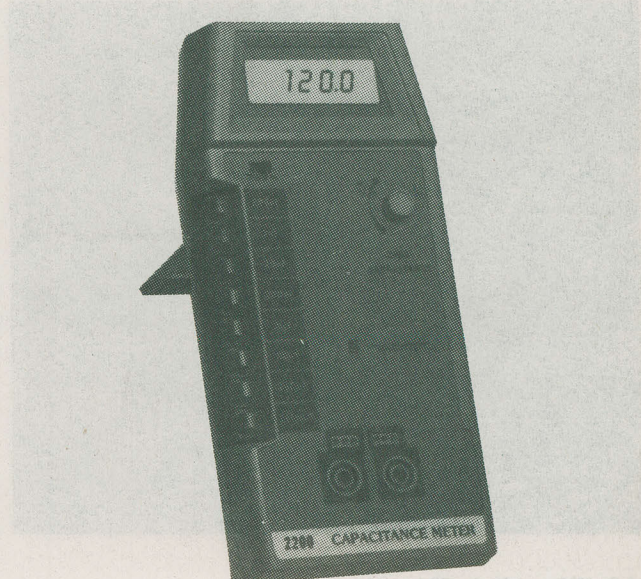
Circle No. 22 on Reader Service Card



Cable Radar

The CCR-2 Cable Radar is a high-resolution cable fault locator. The portable unit is designed to simplify the location of communications cable down to 5" resolution. It is packaged in an aluminum case and uses rechargeable batteries. Clic Instruments Ltd., 2630A Lancaster Road, Ottawa, Ontario K1B 5L8, (613) 731-9030.

Circle No. 21 on Reader Service Card

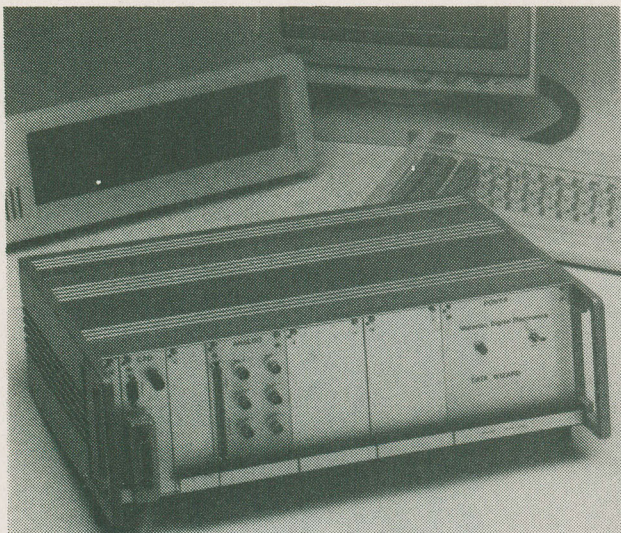


Capacitance Meter

The Brunelle 2200 is a 3 1/2 digit LCD meter that measures capacitance from 200pF full-scale to 2000uF full-scale. The internal circuitry is protected against charged capacitors. Brunelle Instruments, 73-6th Range South, St-Elie d'Orford, Quebec J0B 2S0, (819) 563-9096, Fax 569-1408.

Circle No. 23 on Reader Service Card

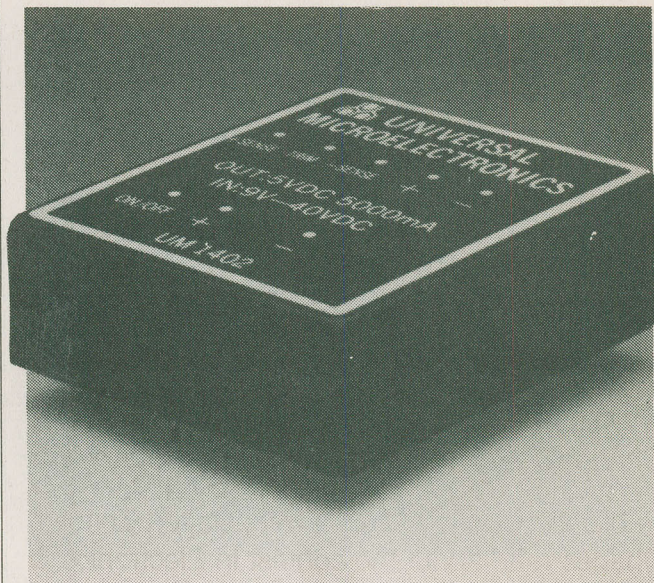
Test and Measurement



Data Acquisition and Control

The DataWizard is a modular data acquisition and control system that can stand alone or as slave to a computer. Designed for OEM and R&D applications, the unit can be programmed using the C language. Input modules have programmable gain and I/O configurations. Waterloo Digital Electronics, PO Box 62, 279 Weber St. N., Waterloo, Ontario N2J 3H8, (519) 884-1842, Fax 884-0315.

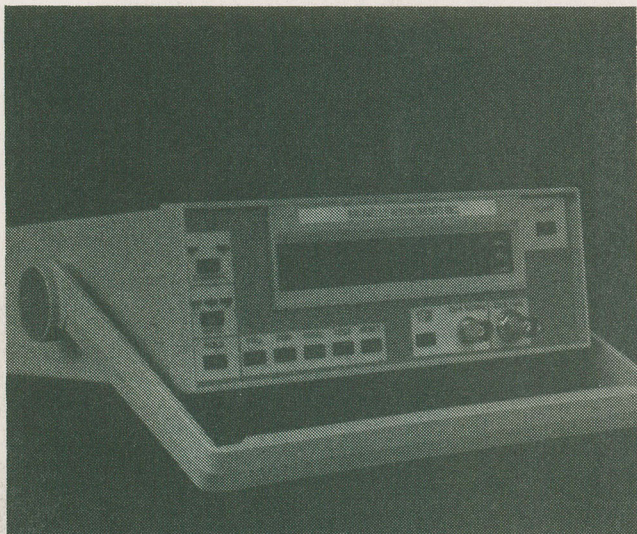
Circle No. 24 on Reader Service Card



DC/DC Converter

For those building or adapting test gear, Universal Microelectronics offers 60 different DC to DC converters from 5 to 15V and 0.5 to 30W. Other features include complete shielding and efficiency to 89%. Duncan Instruments, 121 Milvan Drive, Toronto, Ontario M9L 1Z8, (742-4448).

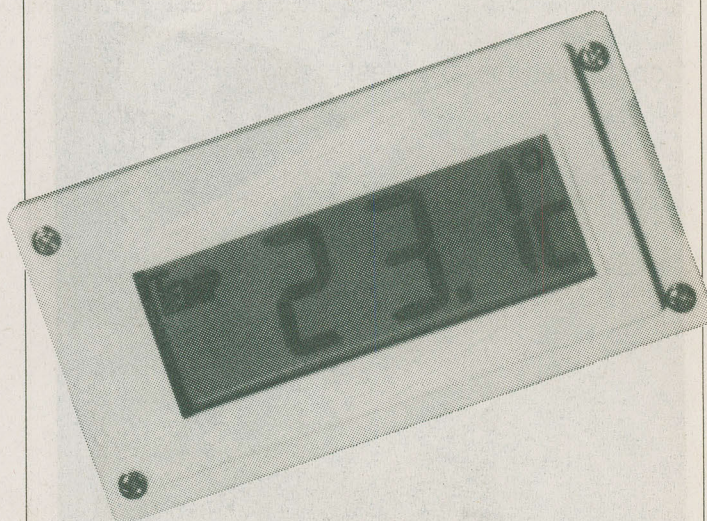
Circle No. 26 on Reader Service Card



Multifunction Counter

The Model 1000 multifunction counter features an 8-digit 7-segment display, soft touch switches, frequency, period, totalize, hold, and a range of 5Hz to 1GHz. The custom microprocessor features low power consumption. Brunelle Instruments, 73-6th Range South, St-Elie d'Orford, Quebec J0B 2S0, (819) 563-9096, Fax 569-1408.

Circle No. 25 on Reader Service Card



Temperature Module

The Soar TX100 is a panel-mounted temperature monitor and controller. Sample rate is 1 or 10 seconds, and the range is -20°C to 70°C. Power is from one AA battery. Duncan Instruments, 121 Milvan Drive, Toronto, Ontario M9L 1Z8, (416) 742-4448.

Circle No. 27 on Reader Service Card

CONGRATULATIONS CHARLES FOX!

TOD REHM, Vice-President & General Manager of Toshiba Canada, Information Systems Division, is pleased to extend his warm congratulations to Charles E. Fox, of Windsor, Ontario. Charles is the winner of the 3rd Annual Toshiba/Moorshead Publications Anniversary Sweepstakes Contest.

Charles read about the contest in Electronics & Technology Today — according to Charles, he has never missed an issue! Charles has his own business in audio-video repairs and video production.

Charles received a prize package worth over \$10,000: the new Toshiba T3100e and the new Toshiba PageLaser 12.

The contest was run in five Moorshead publications: Computers in Education, Computing Now!, Electronics & Technology Today, Government Purchasing Guide and Business Computer News.

Moorshead Publications and Toshiba wish to thank all entrants to the sweepstakes contest. Participation was truly overwhelming.

Congratulations, Charles!

TOSHIBA
WE MEAN BUSINESS
INFORMATION SYSTEMS DIVISION

**Moorshead
Publications**



Ontrak ADR232 Interface

**An economical way
to use your computer
as a controller.**

BILL MARKWICK

A computer of just about any type is a natural for controlling most processes, from a simple heating system monitor to a complex industrial assembly sequence. Their ability to check the status of I/O ports, combined with the decision-making capability of any programming language, makes them ideal as a smart controller.

The hitch comes in when you have to mate various types of sensors to the computer's ports. In most cases, the electrical requirements of the computer's input or output connections will not match those of the outside-world switches, thermistors, etc. The usual way around this is to purchase an analog-to-digital converter board that sits in the computer's expansion slots; its buffered digital and analog outputs can then be used to drive relays, thyristors, other digital boards and so on. The problem with this is that the board must be designed for your particular computer, it's usually expensive, and it takes up one of the expansion slots.

Ontrak Control Systems of Sudbury, Ontario, offers an economical way around this. The ADR232 Interface features eight analog input ports and sixteen digital I/O lines, all for \$240. In addition, it solves the

problem of computer compatibility by using an RS232 link to read information into and out of the computer. If you have an RS232 port, you're away.

Hooking Up

Installation is really nothing more than running a standard RS232 cable between the computer port and the ADR232, plus supplying 5V to the card. Since a supply will likely be available in the equipment you'll be monitoring, you can use that; since the CMOS circuitry of the ADR232 draws only 30mA, you could also run a wire from your computer's power supply connections.

Next, it's necessary to make sure that your computer's serial communications setup matches that of the ADR232, which is 9600 baud, 8 bits, 1 stop bit, no parity. This is usually easy to do (in MS-DOS, for instance, MODE COM1:9600,N,8,1 typed in at the command prompt will set the serial port). It can also be done from BASIC, or from any communications program.

The manual includes a brief tutorial on sending and receiving commands via BASIC; this should be easily adaptable to other computer languages.

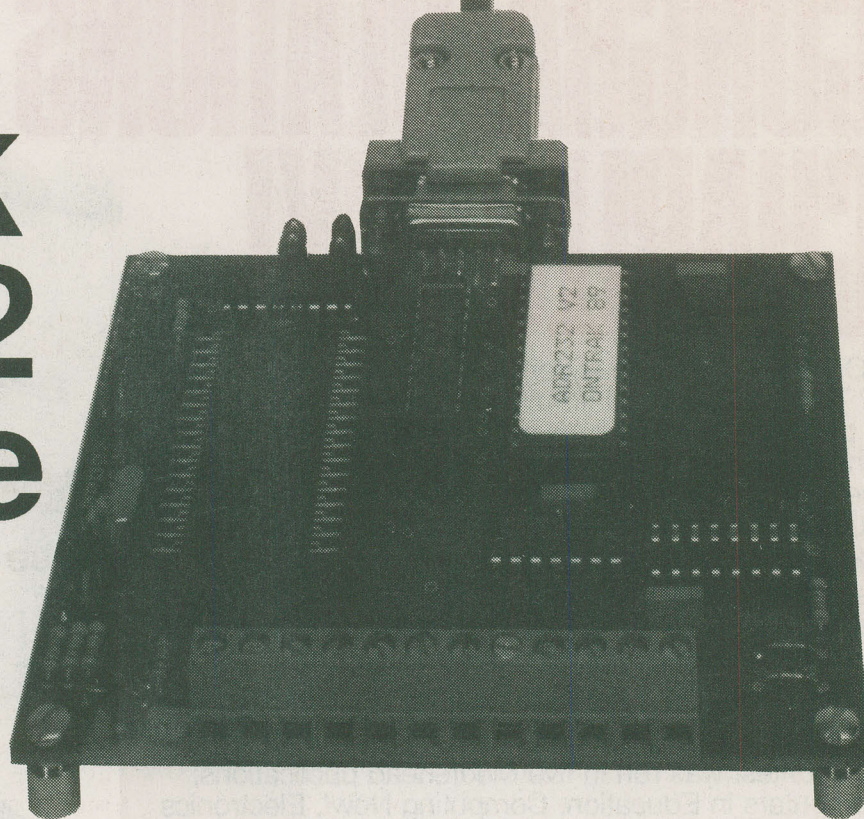
Applications

The supplied manual does not cover installation for any applications, but Ontrak assures us that one is in the works. For the moment, it's assumed that the installer has basic skills in setting up the analog and digital requirements.

The ADR232 would be ideal for such uses as monitoring a weather station, checking greenhouse humidity indicators and turning on water sprinklers, running a lighting system via triacs or relays, or any other application where it's necessary to read analog or digital states and then control the appropriate digital outputs. Science North in Sudbury, for instance, uses a Macintosh and an ADR232 to control the Star Wall display.

Summary

The ADR232 is a compact, versatile, inexpensive method of data acquisition and output control. It would be ideal for industrial applications, hobby uses, educational demonstrations and many other uses. For further information, contact Ontrak Control Systems, 422 Arnley St., Sudbury, Ontario P3C 1E7, (705) 671-2652. ■



The ADR232 Interface uses a standard RS232 cable to communicate with any computer; 8 analog inputs and 16 digital I/O lines use the onboard connectors.

Metal Detector

Build this low-cost project and locate those hidden pipes and wires.

ROBERT PENFOLD

This detector is intended for locating pipes, cables, nails and screws in walls rather than buried treasure. Although it is extremely simple and can be constructed at very low cost, its level of performance is quite good. It can detect quite small screws at a distance of 25 to 50 millimetres. This may not seem to be particularly good, but it requires quite complex circuits to detect small objects at ranges substantially larger than this.

The maximum range of the unit with much larger pieces of metal is not much greater than the range with small target objects. However, as a unit of this type is normally only used for detecting small pieces of metal at relatively small depths, this lack of range on large objects is not of major importance.

The unit uses standard off-the-shelf components, including the search coil. Some metal detectors are difficult to use because the presence of metal is indicated by a small change in pitch from an audio tone. This method of indication can be difficult even for someone with a good sense of pitch. In this case the method of indication is very clear, with a panel LED switching on when metal is detected.

Operating Principle

The block diagram of Fig. 1 shows that basic setup used in the metal detector. Like most metal locators, it is based on an LC oscillator which has the search coil as the inductor in the parallel LC tuned circuit.

In this circuit a feedback control is used to adjust the oscillator so that there is only just sufficient feedback to sustain oscillation. While it might appear that placing metal

near the search coil will have no significant effect on the circuit, it does in fact have a very strong influence on the performance of the oscillator. One effect is to change the value of the inductance by a small amount, but this often exploited effect is not utilized in this circuit. Instead it is the slight change in the Q of the coil that is of importance.

Q Value

The Q value of an inductor is effectively a measure of its efficiency, and the result of metal close to the search coil is to give a reduction of its Q . This slightly dampens the oscillator, and the strength of the output signal decreases. In fact the Q will be reduced to the point where oscillation ceases altogether if even a small piece of metal is brought very close to the coil.

This reduction in the amplitude of the oscillations must be converted into a switching signal to operate the LED indicator. This is achieved using two simple signal processing stages, the first of which is a rectifier and

smoothing circuit. This provides a DC output signal that is roughly proportional to the strength of the AC output signal from the oscillator.

The next stage is a voltage comparator. This compares the output from the smoothing circuit with a reference voltage. If the voltage from the smoothing circuit is lower than the reference voltage, the output of the comparator goes high and switches on the LED. If the output from the smoothing circuit is the higher of the two voltages, the output of the comparator goes low and the LED is switched off.

In practice the feedback control is adjusted so that under standby conditions the output voltage from the smoothing circuit is just high enough to hold the LED in the off state. Metal close to the search coil then gives a lower output voltage and switches on the LED.

Circuit Description

The full Metal Detector circuit diagram

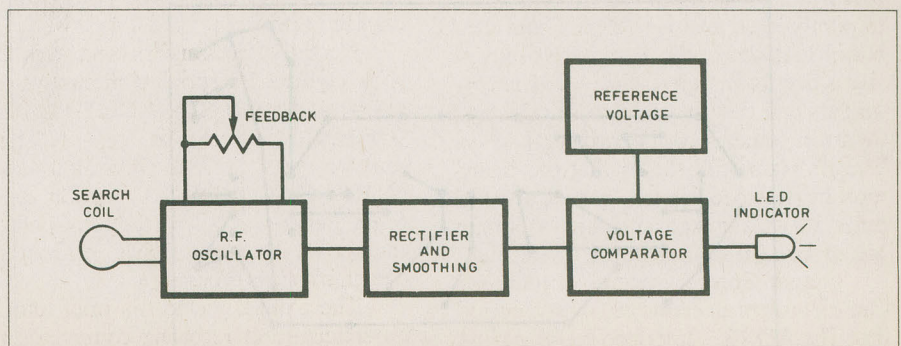


Fig. 1. Block diagram of the basic setup for the Metal Detector.

Metal Detector

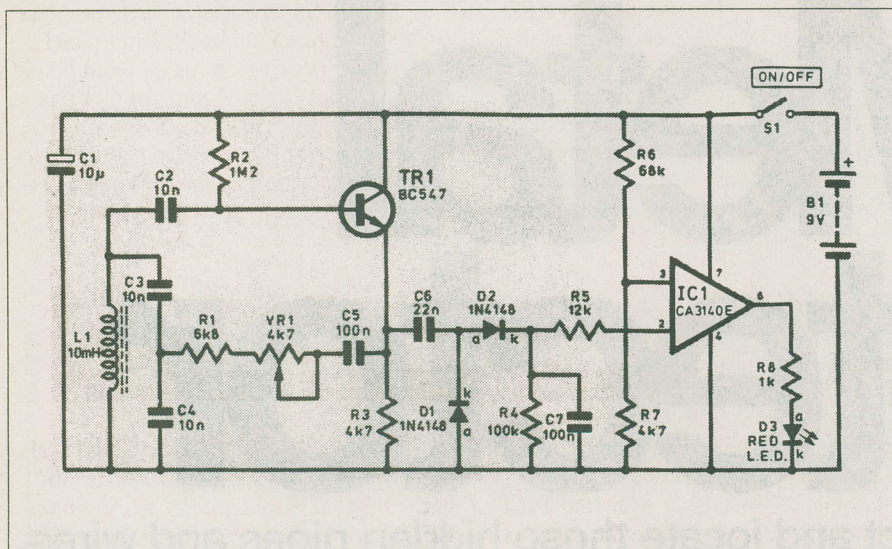


Fig. 2. Full circuit diagram for the Metal Detector.

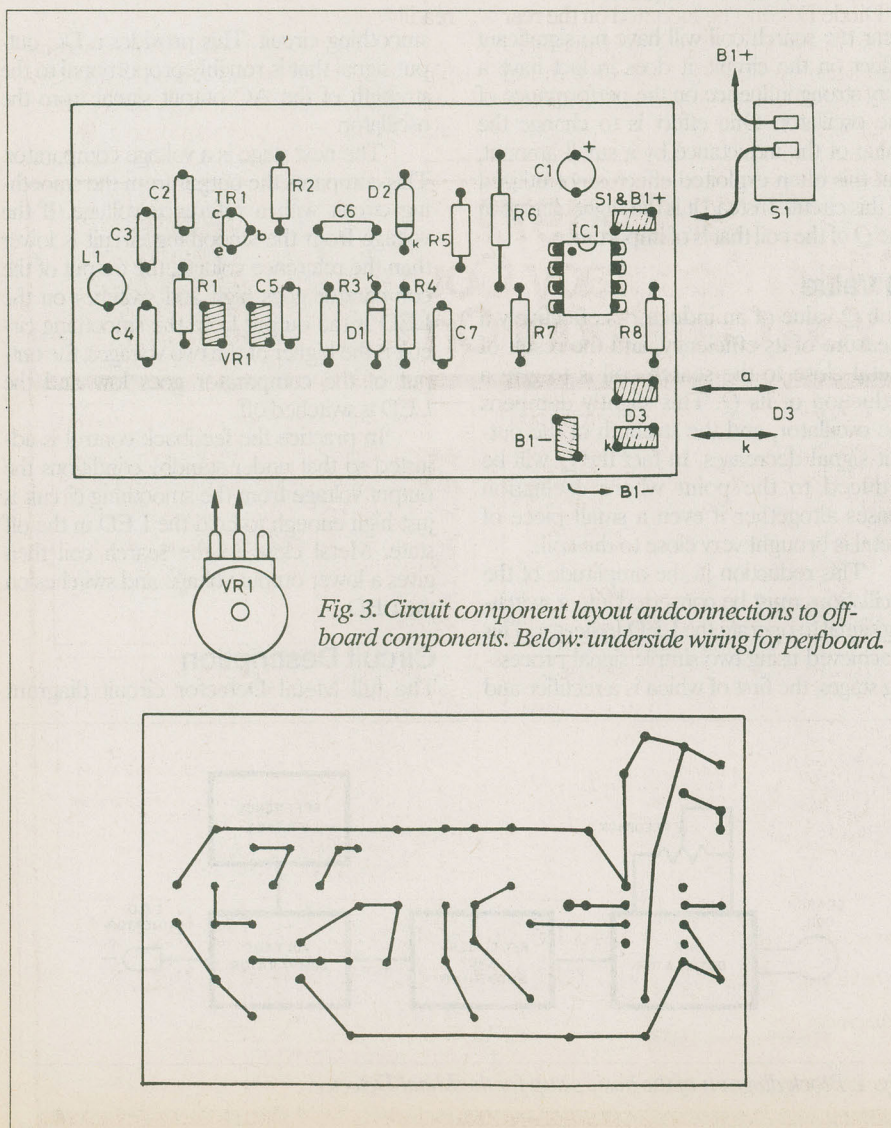


Fig. 3. Circuit component layout and connections to off-board components. Below: underside wiring for perfbord.

appears in Fig. 2. The oscillator is based on transistor TR1 which operates in the emitter follower mode. This provides slightly less than unity voltage gain, but here is a voltage step-up through the tuned circuit which enables oscillation to be sustained.

The tuned circuit is formed by coil L1, capacitors C3 and C4, with the two capacitors providing a capacitive centre tap. Potentiometer VR1 is the feedback level control. With the specified values the circuit oscillates at about 20kHz.

Capacitor C6 couples the output of the oscillator to the rectifier and smoothing circuit. The voltage comparator is an operational amplifier (IC1) used open loop. Due to their very high DC gain operational amplifiers work very well in this role.

Reference Voltage

The reference voltage is provided by resistors R6 and R7. These produce an output voltage of well under 1V, and there seems

PARTS LIST

Resistors

R1	6k8
R2	1M2
R3,R7	4k7
R4	100k
R5	12k
R6	68k
R8	1k
All 0.25W 5%	

Potentiometer

VR1	4k7 lin.
-----	----------

Capacitors

C1	10u elec. 25V
C2,C3,C4	10n
C5,C7	100n
C6	22n

Semiconductors

D1,D2	1N4148 diode
D3	Red LED
TR1	BC547, 2N3904 npn
IC1	CA3140E op amp

Miscellaneous

L1	10mH choke such as Miller 70F102AL
S1	SPDT min. toggle
B1	9 volt battery

Case; battery connector; matrix board (perfbord) or Veroboard; control knob; 8-pin DIP socket; wire, etc.

to be an advantage in a low reference level. This is because a low reference level permits VR1 to be adjusted for a very low level of oscillation without the LED being activated, and a low level of oscillation seems to offer optimum sensitivity. In fact, making resistor R7 even lower in value might give improved sensitivity. Diode D3 is the LED indicator and it is driven from the output of IC1 by way of current limiting resistor R8.

The current consumption of the circuit under standby conditions is about 2.5 milliamps, but this increases to approximately 9 milliamps when the LED switches on. A small 9V battery is an adequate power source for many hours of operation.

Construction

The circuit can be built on Veroboard, or on plain matrix board. Details of the component layout and underside wiring of the board for matrix board are given in Fig. 3. As IC1 is a MOS input device, the use of an IC socket is recommended. Leave the IC in its anti-static package until the unit is in all other respects finished, and try to handle this component as little as possible when fitting it into its holder.

Any 10mH choke should be suitable for L1, such as the Miller series of RF chokes.

Once all the components have been fitted, check that there are no errors and then trim off the leadout wires so that only about four millimetres of each one protrudes on the underside of the board. The wiring is then added from point to point.

Case

The case for this project must be plastic (or some other non-metallic substance) as a metal case would shield the search coil and prevent the unit from functioning. The board must be mounted on long mounting bolts with spacers used to bring coil L1 right up against the front panel.

Having L1 well back from the front panel would effectively reduce the range of the unit. You could even drill a hole for it in the front panel so that its top surface could be brought flush with the front panel.

Diode D3 must be mounted on the rear panel so that it is visible with the front panel placed against a wall. The cathode terminal of a LED is normally indicated by a shorter leadout wire.

Switch S1 and potentiometer VR1 must not be mounted on the front panel as they would prevent the panel from being placed close to walls. Again, the rear panel is probably the best position for these. There is no need to go to great lengths to keep all metal well away from coil L1 as VR1 can be adjusted to compensate for a certain amount of metal close to L1.

In Use

After a final check of the wiring, switch on and try adjusting potentiometer VR1. The LED should switch on with the control fully advanced, but should switch off if it is backed off somewhat.

Optimum sensitivity is obtained with the feedback or sensitivity control VR1 backed off just far enough to extinguish the LED, and for really good sensitivity VR1 must be adjusted very carefully. If you try placing a small piece of metal near L1, such as the blade of a screwdriver, it should be readily detected.

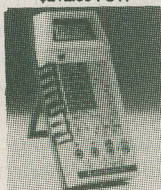
The prototype readily detected screws, pipes, and cables in the walls of my house, as well as some unexpected pieces of metal such as reinforcing over some doors. ■

THE BRUNELLE Commander SERIES

Since 1972
When Accuracy Counts...
You Can Count On Us!



Model 4070
\$212.00 FSTI



4 1/2 DIGIT PUSH BUTTON DMM
High accuracy readings in the laboratory or in the field at a price you can afford. .05% basic accuracy, transistor test function, UL 1244 type test leads, overload protection on all ranges, audio and visual continuity tests.
Ranges:
0-1000Vdc resistance
0-750 VAC 0-20m*
0-10Adc
0-10A Ac

Model 4060B
\$99.50 FSTI



3 1/2 DIGIT PUSH BUTTON DMM
The Job-proven digital multimeter. Housed in shocked resistant ABS plastic, safety design was a prime consideration. UL 1244 type test leads; electronic protection to 500 VACdc, resistance, Normal and low power OHM ranges; 10A ac/dc range; transistor test function.
Ranges:
0-1000V DC 0-10ADc
0-750V AC 0-20M*
0-10 AAC Diode Test

Model 4040
\$155.00 FSTI



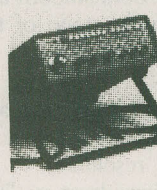
3 1/2 DIGIT ROTARY SWITCH DMM
• 34 ranges
• Built-in 20MHz logic probe
• Frequency counter function
• Capacitance measurement to 20uF
• Diode test
• Dust proof and rugged case
• 2 year warranty
• Many other features

Model 2200
\$112.00 FSTI



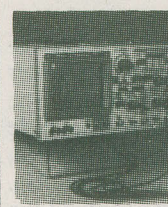
3 1/2 DIGIT PUSH BUTTON CAPACITANCE METER
Unique, easy to use digital capacitance meter, making measurements a breeze. 3 1/2 digital display, tough ABS case, input protection, 200 Hr typical battery life.
Ranges:
1-200PF 2-2uF
0-2NF 0-20uF
0-20NF 0-200uF
0-200NF 0-2000uF

Model 3020
\$324.00 FSTI



FUNCTION GENERATOR
• 7 ranges 0.2Hz - 2MHz
• Square, triangle, sinewave and TTL pulse output
• Inversion feature
• VCF input
• Duty cycle control
• Variable/fixed attenuators
• Rugged cabinet with tilt adjustable handle

Model 2925



35MHz DUAL TRACE OSCILLOSCOPE
• Optimal sensitivity
• Delayed triggering sweep
• X-Y or X-Y-Z operation
• Wide frequency bandwidth
• Complete with X1/X10 probes

Call for pricing it may be the best call you've ever made!

- Call collect to place your order 1-819-563-9096
- Visa, certified cheque, postal money order, purchase orders accepted by approved accounts.
- All products carry a 2 year liberal warranty. • Taxes extra if applicable
- For local service call us for your nearest distributor.
- We also repair and calibrate most other mfgs test equipment panel meter, Modification center for: Beede, CEW.
- New service center for: Logical devices.
- Send for our newest catalogue: Power supplies, generators, etc.

You've tried the rest. Now try the best!

BRUNELLE INSTRUMENTS INC.

73 GODIN SOUTH,
ST-ÉLIE D'ORFORD, QC J0B 2S0
Tél: 1-819-563-9096
FAX: 1-819-569-1408



RCA CC320 CamCorder

BILL MARKWICK

When you pick up the RCA CC320 ProEdit camcorder, every square millimetre seems to bristle with buttons and controls. Besides the usual tape motion and lens adjustments, it adds a titler, A/V dubbing and mixing, autofocus, a time-lapse feature and dozens of other features for taping and editing. It gives you much more control over your tapes, particularly if you take advantage of the editing features by rerecording onto a VCR.

The tape format is a full-sized VHS cassette with normal and extended-play speeds. The CC320 has a suggested list price of \$2199.99, though dealers will probably sell for less.

First Impressions

A camcorder that holds a regular VHS cassette is bound to be a bit large, no matter how small you make the electronics. The CC320 is 42cm long with the rechargeable battery, and weighs 2.7kg. It's well-balanced, though, and doesn't feel uncomfortable. Your right hand falls naturally around the front grip, with its Record trigger and power zoom buttons (an 8:1 zoom range).

The viewfinder is a black-and-white CRT with a wide adjustment range and a focus control; the adjustment is a bit loose and the eyepiece tends to slide away from you quite often. A locking device would be appreciated.

All sorts of information is available in the viewfinder, or on the external monitor if you're using one, including time/date, tape counter, tape time remaining, shutter speed and so on. These features can be shut off if they're unneeded.

The autofocus was fast and smooth, though like all automation it needs to be overruled now and then. A switch near the lens gives you manual with auto override or full auto. The lens is an f1.2 11-88mm with a macro button that lets you focus with the subject almost touching the lens. There's an auto fade in/out button, and amazingly, a clip to hold your lens cap (why didn't someone think of this before?)

The viewfinder is bright and sharp, the power (or manual) zoom smooth and noise-free, and surprisingly, none of the many control buttons got in the way.

When you play back your trial tape on a color monitor, you'll find it as sharp and clear as any camcorder in this price range (the specs don't list the resolution — it's adequate but not quite broadcast quality). The automatic color adjustment works beautifully if you go from tungsten to fluorescent to daylight (though fluorescent tubes, as always, are a photographer's nightmare). The MOS imager works down to 5 lux, which means that you can tape by candlelight; however, things get pretty grainy and fuzzy at these levels, just as they

would with regular film.

The sound is good, and very low on wow and flutter, something that plagues some camcorders. There's the occasional bit of distortion on loud sounds, and of course, the acoustics of the room dominate when the mike is on-camera. There should be a great improvement in sound quality when using external mikes.

You can play back the tape through the camera's viewfinder, of course, and listen to the audio via a tiny speaker next to your ear (or use the earphone output).

If I could change any one thing on the CC320, it would be the tape-motion buttons on the top panel. They're tiny and require a great deal of pressure, something that's particularly annoying when holding down a button during shuttle-search. If the camera's on a tripod, you may have to press the tape buttons several times before making contact.

The manual is excellent, one of the best I've ever seen. It has both quick-start and detailed sections, with lots of cross-references and numbered illustrations.

Power

The included 9.6V battery pack gives a generous 90 minutes before recharging is required; full charge requires two hours. The included AC adapter/recharger clicks onto the camera just like the battery pack,

or the battery pack can click into it for charging. It looks as though you should be able to power the camera and charge at the same time, but sadly, an interlock pin prevents this; the adapter isn't up to handling both loads.

A small dime-type battery keeps the internal clock running when the camera is powered down. There's also an optional adapter for running the camcorder from 12V car power, as well as optional heavy-duty battery packs.

Titles

A panel on the left side slides back to reveal the character wheel and cursor keys. You can dial in 4 lines of 12 upper-case characters each, with two type sizes and 8 colors; this is called a page, and the memory can hold ten pages. In addition, there are 50 frequently used words available ("Birthday", "Wedding", "Directed By", etc).

The character wheel is not as convenient as a fold-down keyboard, but then it does reduce the size and cost.

Bells and Whistles

One very nice touch was a self-timer button,

letting us narcissists appear in the tape without being seen walking into it. Oddly, one push of the button gives a very short recording time; two pushes are required to lock the recording on. I'm not sure what good this feature is.

An auto iris control lets you over- or underexpose, very useful for controlling backlighting.

The shutter speed (which is electronic, not mechanical) can be varied automatically or manually from 1/60 to 1/2000 of a second. This feature is useful only if you have a VCR with very good slow-motion or pause.

There's a manual color control for special effects, plus a negative-positive switch (for viewing print negs).

Time Lapse

The time lapse function lets you set the interval to 30 seconds, 1-2-5 minutes, or manual. The time remaining is counted down in the viewfinder, a one-second exposure is made, and the cycle repeats.

True time-lapse should have a one-frame exposure every interval, but apparently this is beyond the mechanical

ability of a VHS transport. The one-second exposures are fine for something that happens very slowly (plants growing, etc.), but produce a surreal effect in the background (people suddenly appear and vanish at normal speeds, instead of the expected fast-forward).

The "animation" effect is fun to try once, but the one-second exposure time produces jerky action unless you go very slowly.

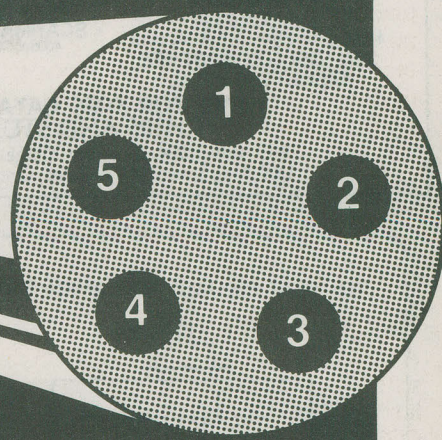
Finally

The CC320's four record/playback heads, flying erase head and full-sized headwheel produced clean, glitch-free edits. The A/V in/out jacks give you great flexibility when used in conjunction with a VCR; you can add soundtracks or narration to an existing tape, for instance.

The construction is sturdy and everything is precisely finished; the camera performed exactly as specified during the time we tried it. If you prefer the approach of having everything in one (rather than a basic camera plus external accessories), the RCA CC320 is an excellent contender in its price range. ■

5 Good Reasons to use Only Multicore Solder Wire....

The 5 Core Advantage



Only Multicore Solder Wire has the distinct 5 cores advantage, and the five good reasons are:

- 1) Flux, being closer to the circumference, will be liberated faster thus increasing the soldering speed.
- 2) Flux absence is reduced up to 120 times less than competitor's single core, meaning less faulty joints.
- 3) The use of high purity metals will increase mobility and wetting force.
- 4) The use of high purity metals increase soldering speed and strength of adhesion.
- 5) Therefore the combination of high purity metals and the distinct 5 cores produces more joints per Kg.



MULTICORE CANADA INC.

12320 April, Montreal, Que. H1B 5N5 Tel.: (514) 645-2378

5730 Coopers Ave., Unit 21-22, Mississauga, Ont. L4Z 2E9

Fax: (514) 645-7574

Tel.: (416) 890-6955 Fax: (416) 890-7034

MARKET PLACE

Portable/Handheld MC68705-P3 ONE-CHIP MICROPROCESSOR PROGRAMMER

Imagine, you can now develop your own One-Chip CPU software, with your own PC and prototype your imagination at will, AND at minimum expense, finally!

C.E.D. CORPORATION has announced a handheld CPU Programmer for the Motorola MC1468705-P3 One-Chip Microprocessor. Now hobbyists and industry alike can develop their own P.C. based software, compile it into a binary file then store it onto an EPROM. The CPU can now be programmed usually in less than one minute, anywhere, anytime with the ONE-CHIP MICROPROCESSOR PROGRAMMER in a "No Experience Required Domain" or in short, a NERD proof environment.

Contact: Canadian Electronics Development Corporation (C.E.D. Corp.)
Box 400, Waterford, Ontario N0E 1Y0 Fax: (519) 443-8925

LIGHT MEASUREMENT CATALOGUE



An updated catalogue describing a broad range of light measurement instrumentation for use in all environments is available from International Light Inc. It includes radiometers, photometers, spectroradiometers, detectors, filters and various accessories.

INTERNATIONAL LIGHT INC.

17 Graf Road, Newburyport, MA 01950
Phone: (508) 465-5923 FAX: (508) 462-0759.

CHIPS AND STUFF ELECTRONIC COMPONENTS

quality at low, low prices

THIS IS JUST A SAMPLE OF OUR PRICES

IC'S

7400N...\$23, 7420N...\$25, 7492N...\$71,
74502...\$42, 74S244...\$1.73, 74S374...\$2.16,
74LS03...\$26, 74LS37...\$38, 74LS196...\$86,
74S474...\$12.21, C2516-45...\$9.90,
AV5-1015D...\$8.17, MB8877...\$21.37,
C4116-20...\$1.47, C4164-15...\$4.77,
PAL16L8ANC...\$8.02, PAL20L8ANC...\$10.87

RESISTORS

1/8 1/4 1/2 WATT \$.07

IC SOCKETS

14PIN...\$12, 16PIN...\$13, 20PIN...\$13

3 1/2" DSDD ERROR FREE
DISKETTES @ \$1.62

5 1/4" DSDD ERROR FREE

DISKETTES @ \$.40

(ALL DISKETTES COME WITH LABELS)

PRINTER RIBBONS

(FULL MONEY BACK GUARANTEE)

ALPS 2000 @ \$8.17, CENTRONICS 150/152 @

\$4.04, EPSON FX, MX, RX 70/80/85 @ \$4.54

30Mb HARD DRIVE

M8434, 3 1/2", CONTROLLER

Manual, Cables, AT/XT. ONLY \$415.00

SCANMAN HANDHELD SCANNER

400dpi, CONTROLLER AND SOFTWARE

ONLY \$350.00

WRITE FOR FREE CATALOG TO
CHIPS AND STUFF

P.O. Box 31004, Kingsway Village Postal Outlet,
1300 King Street East, Oshawa, Ontario L1H 8N9

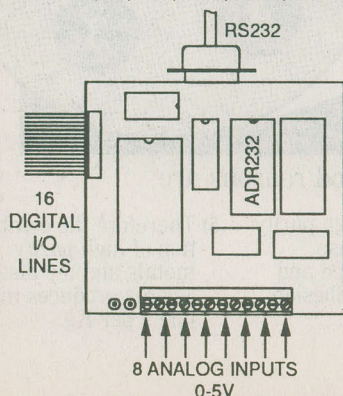
Get the
best of
professional
creative
services

- Complete Desktop Publishing
 - Expert Editorial Management
 - Creative Marketing & Art Direction
 - Professional Photography
 - Extensive Direct Mail Services
 - Moorshead Publications Reprints
- and much more...

Call
MP
COMMUNICATIONS
Kenneth Marskell
(416) 445-5600

A New Division of Moorshead Publications
1300 Don Mills Road, North York, Ontario M3B 3M8 FAX: 416-445-8149

TO: XT, AT, PS2, MAC, NeXT, AMIGA, ETC.



Ontario Residents Please add 8% P.S.T.

ANALOG/DIGITAL/RS232 INTERFACE INTRODUCING THE ADR 232

The ADR232 allows any computer or terminal with an RS232 port to read analog voltage levels and control 16 digital I/O lines using simple commands sent via an RS232 port.

FEATURES:

- Simple commands
- 100% CMOS low power operation (5v @ 30 mA.)
- 8, 8 bit analog inputs
- 16 digital I/O lines
- 9600 baud
- Easy to use with BASIC programs
- Made in Canada

\$240.00 POST Includes: ADR232, Manual, 9 pin to 25 pin RS232 cable.
PAID (Requires separate 5 vdc supply at 30 mA.)

To order send cheque or money order, or
for more information, send name to:
(Educational or corporate P.O.s accepted)

ONTRAK CONTROL SYSTEMS
422 Arnley St.,
Sudbury, Ontario.
P3C 1E7 (705) 671 2652



MOORSHEAD
PUBLICATIONS

SOFTWARE
CATALOGUE
SUMMER
1989

And then...
Maxell created
the RD Series.



The
Evolution
of the
Floppy Disk

Never before has this level of Reliability
and Durability been available in floppy disks.
Introducing the new RD Series from Maxell.
Twice the durability of the disks you're now using.
Twice the resistance to dust and dirt.
And the RD Series is ten times more reliable
than conventional floppy disks.
The Gold Standard has always meant maximum
safety for your data. Now it means even more.

Griffco

Toronto (416) 625-6559, Montreal (514) 387-3183, Calgary (403) 255-3496, Vancouver (604) 669-8138



maxell
THE GOLD STANDARD

Circle No. 99 on Reader Service Card

ALMOST FREE™ SOFTWARE

VOLUME 1

PC-WRITE An earlier, compact version of this well-known word processor — perfect for program editing. PC-Write boasts features such as user-definable help screens and a 'printer ruler file' which can be customized to work with virtually any printer.

SOLFE is a small BASIC program that plays baroque music. While it has little practical use, it's a lot of fun. It's also a fabulous tutorial on how to use BASICA's sound statements.

PC-TALK A high-power telecommunications program for a low-power price. It does file transfers in both ASCII dump and MODEM7/-XMODEM protocols. And, it comes with a large documentation file.

SD This sorted directory produces displays which are a lot more readable than those spewed out by typing DIR.

FORTH This is a small FORTH, written in Microsoft BASIC. A good tool for teaching the ideas and concepts of this esoteric, but useful language.

LIFE This is an implementation of the classic ecology game written in 8088 assembler code.

MAGDALEN This is another BASIC music program.

CASHACC is a fairly sophisticated cash acquisition and limited accounting package written in BASIC. It isn't exactly BPI, but it's a lot less expensive and suitable for many small business applications.

DATAFILE is a simple data base manager, written in Microsoft BASIC.

UNWS Convert WordStar documents to standard ASCII files.

HOST2 This program includes BASIC source and documentation files to allow users with SmartModems to access their PC's remotely.

\$19.95

VOLUME 2

SWEEP is a disk utility which virtually replaces the DOS COPY, REN, TYPE and DEL commands.

WORLDMAP is a graphics program which draws a very detailed map of the world. It can display its wares on your monitor, or send them out to a dot-matrix printer. CGA required.

ANITRA plays Anitra's Dance by Edvard Grieg. A beautiful addition to your computer music collection.

RAMDISK is one of the most useful utilities you'll ever plug into your PC. Once installed, it creates a virtual drive in memory on your PC.

ALIEN Plays a bizarre adventure game and will lead you into some of the most exotic spots in the universe.

FOS is a well designed personal

finance manager which will do much to help you tame your cheque books.

JUKEBOX represents yet another PC music system. This one comes with a host of songs and some really electric graphics.

ASMGEN is one of the best text disassemblers we've come across. It takes any executable COM or EXE file and produces an assembler listing. It's surprisingly good at distinguishing between code and embedded data or text.

STRUCT will appeal to the rabid programmer in everyone. It enables MASM to be used to assemble a higher level language. Included also is a test file to illustrate the syntax.

PRTSC replaces the internal PC screen dump code with something more suited to reality. It allows one to hit the PRTSc* key and then select the print quality from a menu. It supports a number of popular printers.

BREAKOUT plays a PC version of the popular game. It will accept input from either a joystick or the keyboard. The graphics are good and the action is adjustable from a beginner's level right up to 'fast and nasty'.

UTIL is a collection system utilities which can be accessed from a single menu. Among its talents are a sorted directory, keyboard redefinition and the facility for scrolling through text files.

\$19.95

VOLUME 3

WRT DOS allows files to have a 'read only' flag, but it lacks a way of manipulating them. This pair of utilities allows you to set and unset this flag, protecting files from accidental erasure.

BROWSE is a timesaving program which provides a useful alternative to the DOS 'TYPE' command. BROWSE allows you to easily scroll through text files in order to have a quick look at a text file.

CAT If the DIR display is too dull for your taste, CAT may be just what you need. It will tell you everything you could possibly want to know about the files on your disks.

CGCLOCK is a simple little program which displays the running time in the upper right hand corner of your screen. Works with CGA displays.

CURSOR A tiny twenty-four byte program which displays a large cursor on your monitor.

CMP This program does a very elaborate comparison of two files and reports their differences.

JUMPJOE A bit like "Miner 2049'er", this game is certain to damage your mind. You get to be the janitor of a space station and deal with berserk robots and other weirdness.

CASTLE Wander through a deserted castle collecting treasures... but don't get killed by the nasties. A solution is

included should frustration set in.

78INT This small BASIC program calculates interest using the rule of seventy-eight.

MOON is one of the nicest lunar lander games we've come across. This version uses high resolution graphics and startling sound effects to hurl you to your doom in style.

PERTCHT is a BASIC program which prints PERT charts. It should interest anyone involved in project management and scheduling.

DATNOIDS is one of the strangest games ever put on a disk. In fact, mere words don't serve to describe it: you'll have to try it for yourself.

NUK-NY This is one of the nastiest bits of software we've seen. It produces a full color high resolution simulation of a nuclear attack on New York City.

\$19.95

VOLUME 4

BACKSCROLL Perhaps one of the cleverest DOS utilities, BACKSCROLL hooks itself into the PC and buffers whatever scrolls by. Using a well-thought out command structure, it allows one to scroll through text which has already scrolled off into oblivion.

BIGCAL is a BASIC program which performs calculations on extremely large numbers.

BUGS is an off the wall ASCII game in which a player uses the cursor pad keys to move a 'nuclear fly swatter' around the screen blowing up a bug.

CRYPTO is a BASIC program which unscrambles cryptograms. It's an great study for puzzle enthusiasts.

DEFRAG is a utility that lets you "de-fragment" your disks to make your applications run faster. The utility reorganizes a disk, connecting up the fragments of files created by DOS.

DOSEDIT enhances the command line facility of MS-DOS by creating a command stack. Instead of merely being able to recall a command with the F3 key, DOSEDIT lets you use the cursor arrow keys to scroll through a whole stack of previously entered commands, re-executing the ones you need.

DUMP is a utility program designed to produce Hex dumps of object files.

FREE is a tiny file which tells you how much space is left on a disk... without having to view an entire directory listing.

KBFX displays the status of the keyboard lock keys on the screen and expands the size of the keyboard character buffer to avoid losing bytes.

LABEL changes the labels on disk drive volumes. It's a simple utility, but useful if you use volume labels to keep track of your disks.

LIST is an improved version of the DOS TYPE command which shows you the contents of a file page by page.

MEMBRAIN is the most sophisticated RAM disk program we've seen yet. It lets users install variable sized disks and provides control over several other parameters.

MONOCLOK is a screen clock display program, designed specifically to work with monochrome displays.

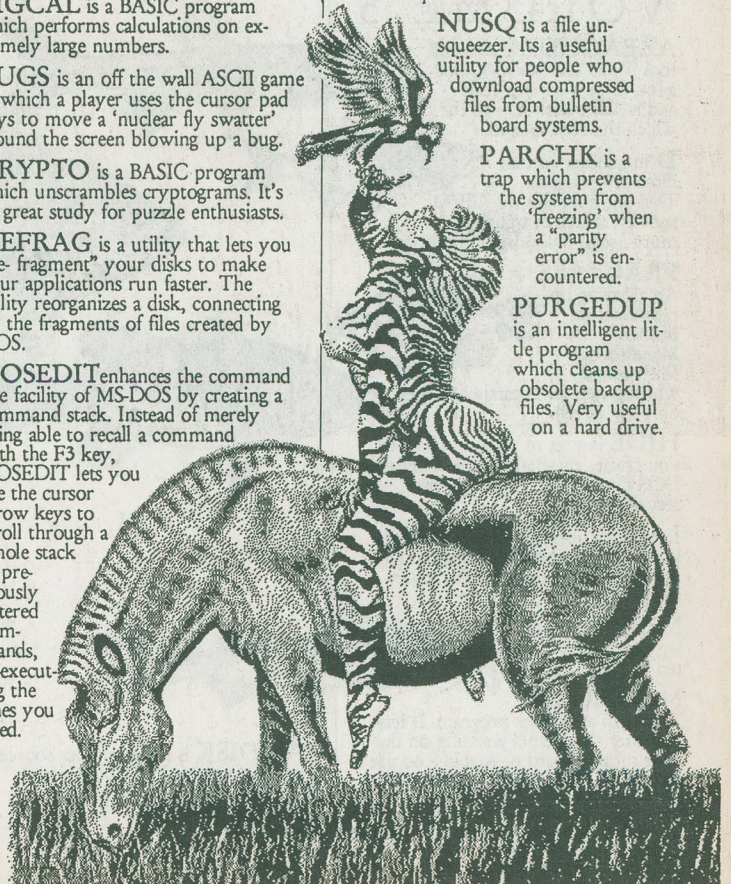
MOVE is a disk utility which moves and optionally erases disk files. Using wild cards, the user can ensure that specific types of files are not MOVED by the program.

NEWBELL is a tiny program which performs the lowly task of changing the sound of the PC's control G beep.

NUSQ is a file unsqueezer. Its a useful utility for people who download compressed files from bulletin board systems.

PARCHK is a trap which prevents the system from 'freezing' when a 'parity error' is encountered.

PURGEDUP is an intelligent little program which cleans up obsolete backup files. Very useful on a hard drive.



PX is a cross reference generator for assembler programs. It helps you keep track of where you put procedures in large files.

QS is a DOS patch which eliminates some of the wait encountered when DOS is booted while it performs a number of system checks. The program is not compatible with all software, but is still handy to have.

SDIR is an improved sorted directory program.

SP is a clever print spooler which lets you 'print' files into a RAM buffer, leaving the user free to move on to other tasks using the computer.

SPACE INVADERS A fast variation of this popular arcade game. The graphics are superb.

SPEED is a simple program which changes some of the PC's floppy disk parameters and effectively speeds up disk accesses for some applications.

VDEL is a multiple deletion program that queries the user prior to erasing each entry. Similar to **MOVE**, but much smaller.

WHEREIS will locate a file on a disk even if it lurks in a subdirectory. Most useful on hard disk systems.

WIZARDS is an adventure game in the classic style, except that it ranks as one of the most sarcastic programs in creation. The program is vast... you can wander about its darkened corridors for hours.

\$19.95

VOLUME 5

AREACODE is a useful tool if you use the telephone a lot. Give it an area code and it will match it with the city in which the code is used.

D in another sorted directory program. This one emulates the CP/M style D, which is arguably more useful for most applications.

FRACTALS

An amazing implementation of the Mandelbrot Microscope, which generates unearthly images on your screen.

HIDE is a set of utilities which let you create, enter and remove invisible DOS directories. An inexpensive security strategy.

LAR is a library utility that allows you to concatenate several small files into a library to save on disk overhead.

MAIL1 is a mailing label utility written in BASIC.

MORERAM

This is an assembler program. It lets you alter the memory setting on the PC's motherboard to enable it to use more than 640K RAM. MASM & LINK Required.

MORTGAGE generates amortization charts.

MXSET lets you control the

parameters of Epson printers from the DOS command line.

PARCHK is an assembler program which requires MASM and LINK to work. It installs a trap for parity errors in your computer.

VDEL is a Delete with Verify program.

WHEREIS finds files in a complex hard disk system.

ZAXXONPC This is an incredible implementation of one of the most popular micro games ever created.

\$19.95

VOLUME 6

3-DEMON is one of the most interesting variations on Pac-Man in the known universe. Instead of simply looking at a map of a maze, this program shows you a three dimensional view of it.

DU allows you to see what the tracks and sectors on your disks look like, recover erased or damaged files, and meddle with the system tracks.

GENERAL LEDGER This is a complete general ledger accounting program. Written in BASIC, the program possesses most of the features found in commercial packages. Documentation included.

PC-CHESS is a slick chess program which makes good use of the PC's colour graphics abilities and boasts a running chess clock.

TYPE and even run programs... in short, it does almost everything DOS does but it's user-friendly.

QMODEM is a sophisticated telecommunications program that includes windowing, multiple protocols, and definable function keys.

ARC is a clever file archiving program which stores multiple files in single library files.

ZAPLOAD is a utility for programmers to handle Intel standard HEX files. Very fast and well documented.

JSB Another BASIC music program for your collection. This one plays a soothing sonata.

STAR is one of a growing breed of small... somewhat silly... novelty programs. This one, as you might guess, draws stars.

SURFACE demonstrates the complexity of the "hat" function by graphing it.

OP is the operator program from the November '85 issue of Computing Now!

\$24.95
(2 Disk Set)

VOLUME 7

BLACKJACK is a BASIC implementation of this popular card game.

EDSCR is a screen editor which can be used with virtually any programming language from assembler to dBase III.

FK allows you to make the function keys of your PC do more useful things under DOS.

FXMASTER is

a printer program for the popular Epson FX Series and compatible printers. It uses

a full screen menu to enable you to easily

change printer settings and modes.

INDEX allows you to generate indexes from WordStar documents... or text files from any other text editor.

KEYCLICK is a memory co-resident program which will make your keys click.

PCBW is a small utility which makes colour screen displays show up in monochrome video. Great for users with colour graphics cards and monochrome monitors.

PINBALL is a pinball simulation that is easily worth the cost of this disk

QUICKGRAF is a powerful business graphics package which generates complex bar, line and scatter charts in medium and high resolution. An Epson with GrafTrax or compatible printer is necessary to produce hardcopy.

SERPENT is a variation on the classic snake game. Written in BASIC, this one is weird, but very fast.

SHOWCLK is yet another clock program... its the smallest one yet, and it beeps to chime the hour.

VTREE is a graphic TREE program that shows you how the subdirectories are set up on your disk... in a fashion more easily understood than the MS-DOS TREE utility.

WORLD is a great program which allows you to zoom in on specific areas of the globe, locate major cities and perform a number of useful calculations.

\$19.95

VOLUME 8

DDCAL is a very clever perpetual calendar and desk diary. It keeps track of your appointments and performs several other functions.

PC-KEY DRAW is a great public domain paintbox program which compares favorably with many commercial applications. It'll handle multiple screen images, business graphics and superb computer art — all in full colour.

CPU is a tiny program which tells you the effective speed of your system.

XRAY is a remarkable co-resident utility which monitors what a program is doing while it's busy doing it. It allows you to interrupt the execution of your code and a look inside.

GAME — well, there are no words for this program, or, at least, none that are printable. It does use some suggestive language, and we recommend that young or sensitive users not boot it.

TUNE is a very small music generator which makes noises from within batch files.

CHASM, or cheap assembler, is just the thing if you want to get into assembly language programming but don't want to spring for the Microsoft macro assembler package.

GETDIR is a resident directory utility. It allows you to see what files are on your disks, even if you're in the middle of doing something else.

COPYPC, not to be confused with the commercial Copy II PC, is a quick disk backup utility.

LOOKIT is a browsing program that lets you scroll forward and backwards through text files — like a tiny word processor with no editing features.

SYSLOCK is a security device for hard disk users. By running this utility on your XT or compatible, access to your computer will only be granted to users with a valid password.

\$24.95
(two disk set)

VOLUME 9

SMALL C is a restricted implementation of C, producing code which is compatible with Microsoft's MASM and LINK programs — you'll need these to get it going.

MAP is an interesting little utility which will check how DOS is situated in the memory of your computer and tell you a number of things about it.

NOTE is the source file for the memory resident note pad which appeared in the March 1986 edition of Computing Now! It requires MASM and LINK to use.

PANGO is one of the wildest games we've come across for the PC. While its premise is a bit improbable, it's fast and weird — hours of fun.

PC-SPell is a spelling checker written in BASIC. It's fast, accurate and easy to use. It can be listed if you want to see how it works, and comes with a large dictionary file and a utility to assist you in customizing it.

PEACOCK is a memory resident program which allows you to change the colours of your screen with alternate function keys.

RECOVER is a file recovery utility. It lets you look at your files one sector at a time in order to put the pieces back together.

SDB is a small relational database. It isn't dBASE III, but it also doesn't cost quite as much.

TALLY is a program which accurately counts the number of characters, words and lines in a file — all within your lifetime.

XENO edits the tracks and sectors of your disks in a user friendly format — or, at least, one that doesn't lunge for your throat every time you boot.

\$19.95

VOLUME 10

MONOPOLY A good implementation of the classic board game. Great graphics and sound. Slightly sarcastic play.

D20 is the latest version of Steve's sorted directory program. This one uses DOS two calls and handles sub-directories.

EDIT is a lightning fast full screen editor, ideal for editing program source files, dBASE stuff or other ASCII phenomena.

BANNER takes mere text and prints it sideways on your printer — in gargantuan block letters that can be read from miles away if you have a good set of binoculars.

MORTGAGE is one of the nicest mortgage programs we've seen so far — lifelong debt and ruination has never been so well formatted.

QUICK speeds up your PC quite a bit by improving video response.

SPEECH is a rather remarkable little germ of code. It talks through the PC's internal squeaker speaker. The voice isn't exactly human, but it's understandable on most machines.

PC-AR is an accounts receivable package for the PC. It will take care of the records for a small or medium sized business quite well.

\$19.95

VOLUME 11

PAC GIRL is, predictably, a variation on the almost mythical Pacman game. This one moves fast, and plays much like the arcade version.

MENU lets you create a menu-driven tree-structured environment that is friendlier and more manageable than is DOS.

Z80MU is one of the most brilliant pieces of software we've ever encountered — free or not. It actually emulates a Z80-based computer running CP/M on the PC with no additional hardware — you don't even need a V20. It will run almost all CP/M software, including old favourites like WordStar and dBase and includes features lacking in both C/P/M and MS-DOS.

SERIO is the assembler file from the July edition of Computing Now! that implements an interrupt-driven terminal in higher level languages such as C. It's also suitable for use with compiled BASIC. Both MASM and Link are required to use SERIO.

BREAKDOWN is a peculiar program which takes meaningful text, analyzes it and generates meaningless, but profound-sounding prose from it. If you've been wondering if your co-workers really read your office memos and reports, try filtering your prose through this program. The effects will be astounding.

XMODEM is a C language implementation of the XMODEM file transfer protocol, from the July 1986 edition of Computing Now!. It can be integrated into other programs to allow easy access to telecommunication facilities. This code requires SERIO (see above) and version three Lattice C.

GRABIT is the screen grab program from the July 1986 edition of Computing Now!. It will make a useable text file from the contents of ones screen at the touch of a key. MASM and Link are required.

\$19.95

VOLUME 12

CV is a small utility for changing the volume name on disks.

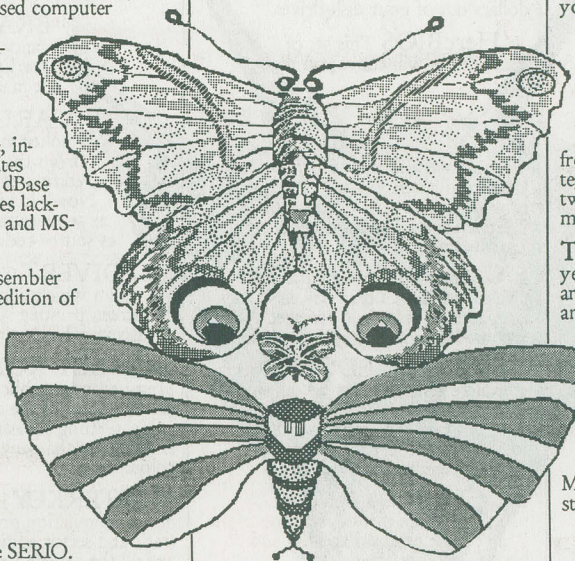
BREAKOUT BOX is an assembly language program that hides in memory and shows you what your serial ports are doing. It's a valuable trouble-shooting utility for pin-pointing serial printer and modem problems.

ICON MAKER allows you to generate sophisticated bit-mapped

images. Its easy to use and extremely colourful, producing data that can be incorporated into other programs.

SHELL is another DOS menu program. This one is very fast, free of 'snow', and provides easy access to virtually all DOS features.

STRIKER is an experience. It's a brilliantly written helicopter game in the style of Choplifter, complete with professional high resolution graphics and running spies.



RAMSET is a RAM expansion program from the July 1986 edition of Computing Now!. It allows you to exceed the PC's 640K memory limit. Ramset also lets you bypass the PC's time-consuming memory check.

TRAP is the high-resolution Gemini patch program from the May edition of Computing Now!. It makes the Gemini 10x suitable for use with Personal Composer, but is easily modified to fix most bit-mapped printing problems. MASM and Link are required to assemble the program.

\$19.95

VOLUME 14

CUT AND PASTE is a memory resident program that allows you to grab text from the screen of any application and paste it into any other application that accepts characters for input.

INT13 will help you unravel the copy protection schemes of your software so you can make archive copies — just in case the cat takes a fancy to your masters. It prints a log of direct disk accesses and where they're called from so you can check out the code that's going after specific tracks, the heart of most protection systems.

PMAP tells you what's living in the memory of your system — and where.

It will help you to find the resident utilities you have loaded and, more important, is great for sorting out peculiar interactions between multiple resident programs.

SOFT TOUCH is a keyboard macro program not unlike ProKey. It allows you to store up to twenty five thousand key strokes, has a built in screen blanker and great wandering herds of other features.

SUB CHASE is a first rate graphics arcade game. One sails across the clear blue sea — or green sea, depending on what sort of monitor you have — heaving depth charges off the stern to blow up subs. Requires a colour graphics card.

TheDRAW is an ANSI screen editor. It allows you to create and edit full colour screens of text and graphics which can be displayed from DOS — in full colour — or integrated into programs. Requires DOS two or better, ANSISYS, and is more fun with a colour monitor.

TREK is the best Star Trek game yet devised for the PC. The graphics are stunning, the complexity is intense and the action scoots along at warp nine as soon as the program gets going. Requires a colour card.

CROSSWORD is a utility which translates text files from one application to another. It supports several popular word processors, including WordStar, WordStar 2000, Multimate, XYwrite, SideKick and standard ASCII.

\$19.95

VOLUME 15

ALTAMIRA This is one of the nicest public domain paint box programs available for the PC. It does first rate pictures. Colour graphics card required.

FRACTAL This is the C source code for the fractal generator that first appeared in the August 1986 issue of Computing Now! Requires a C compiler and a colour graphics card.

NEMON This is a really weird game. You get stuck in the catacombs of king Nemon with nothing more than your wits and a flashlight. You have to find some keys, some treasures and, hopefully, a way around a host of arcade game nasties.

THOR used to be the god of thunder. Now he appears to be the world's most sophisticated desk calendar program for keeping track of appointments.

ROUND 42 This is bizarre variation on the theme of space invaders. One of the best computer games in creation. Requires a colour graphics card.

V20 is a CP/M emulator for users of the NEC V20 chip. Replace your existing 8088 with a V20, score this little program and most CP/M software will run on your system as if someone had stolen half the bits out of your PC. Regular MS-DOS isn't affected. Requires a V20 chip.

\$19.95

VOLUME 16

ARCDIR The archive file compression system is the most efficient way to store large files in a small space. This simple ARC directory utility was featured in the November 1986 edition of Computing Now!. It includes both a COM file and the source code so you can see how it works. Requires a C compiler if you want to meddle with it.

BRICKS The "Little Brick Out" game is one of the classic programs for microcomputers. This splendid version will get you turned onto simple games all over again.

DX This is a small DX-7 voice librarian, as found in the Book of Computer Music. It includes both a COM file and the assembler source code.

MOREROOM If you have a hard drive system you may have noticed that it's extremely inefficient with small files. Here's a collection of tricks to get substantially more space on your disk.

E88 is a tiny — but powerful — text editor. Neat and compact it is perfect for programming.

EXPERT Commercial Expert Systems software is still in its technological infancy. If you're interested in learning about expert systems and how they relate to your computing needs, you should try this simple program.

FULLDOS A DOS enhancement program that makes the DOS user interface behave in a rather more friendly manner. It creates a command stack and lets you re-execute previous commands.

K9 This is yet another resident keyboard enhancer — with a difference. Aside from expanding the keyboard buffer, installing a screen timeout and so on, it makes a number of the alternate keys 'hot', giving you dozens of unique functions.

InstantMENU This is the code for the Instant Menu article which appeared in the November 1986 Computing Now!. With it, you can create elaborate batch file menus without programming. Menus can be easily altered with a text editor or word processor. Source code is included.

PALERT We've all occasionally run out of disk space while inside an application and discover that we've been dumped back to DOS unexpectedly. This program warns you of an impending full disk.

\$19.95

VOLUME 17

ARC512 This is the latest version of the de facto standard PC file compression and archiving utility. It will

create, maintain and crack/unpack ARC files. See the November 1986 edition of Computing Now! for more about this.

ATC ATC stands for "Air Traffic Controller". In this colourful simulation of the rigors of managing the planes at a busy airport may, among other things, renew your interest in train travel.

DRAW POKER This is a really slick little poker machine simulation. The graphics are good, the play is fast and the machine doesn't always win. It's a shame it won't spew silver dollars out of your disk drives.

HercBIOS This set of routines will allow you to

include an elaborate event timer, a note pad, an ASCII code chart and so on. It's well done, fast, and fairly small.

PD This program redirects the output of one's system from the printer port to a disk file. It lets you to use things that normally insist on having a printer on line even if you don't own one, or don't want hard copy.

\$19.95

VOLUME 18

BRADFORD A fancy printing program for Epson and Gemini dot-matrix printers.

CARD This is the draw poker machine program from the December 1986 edition of Computing Now!. It's included here both as an executable COM file and as source code in C.

DIVERT This is a tiny program which doubles the effective screen printing speed of most programs which print through DOS.

DONKEY KONG This is a pretty snappy public domain implementation of the classic arcade game. Getting squashed by oil drums is more fun than anything. Requires a colour card.

MASTERKEY is a public domain disk manipulation program that offers track and sector editing, unerasing files, and all the general low level fiddling that the expensive programs do.

PRINTER This is the PRINT-ER.BAS program from the December 1986 edition of Computing Now!. It reprograms the high end characters of an Epson FX-80 (or compatible) printer to make them print IBM PC screen block graphics.

QUICKEY This little program speeds up keyboard action.

ZOARRE This is another dungeon game, but terrifically well done and very intricate. It displays a picture of the room you're in, zaps you with various monsters and generally tries its very best to kill you. If you liked Castle you'll freak over this one.

\$19.95

VOLUME 19

BOTH is a small utility which can slash your paper bill by allowing you to print long files on both sides of the paper.

DIAGS Written by the author of Z80MU, this collection of tools will be nirvana for the experienced PC programmer. It does things like generate an annotated list of all the interrupt vectors in your PC, let you meddle with the 6845 registers, test most of the ins and outs of your system and so on. It's a brilliant bit of work.

GRCP Graphic cut and paste is a memory resident tool that allows you to scoop things from a PC high resolution graphic screen and pop them into other applications.

LOCKERUP This tiny microbe of code sleeps in your system until you have to leave your PC for a while. Then it enables you to irrevocably lock up your keyboard until you come back to restart it. It's perfect for offices where there are more fingers than hands to contain them.

MEGAPEDE Just when you thought that it was safe to play ASCII games again... This one is a sophisticated variation of the classic "snake" programs and it plays with the speed of a boa constrictor. Don't count on winning for a while.

MURPHY Sort of an iconoclast in a can, this program will print a random selection of several hundred of Murphy's laws, corollaries and commentaries thereon each time it's run. If you put it in your AUTOEXEC file it will say something clever each time you start your computer.

QUEBERT This fast PC implementation of the classic arcade game is every bit as exciting as the real thing but lacks a coin slot. Jump down the mountain, avoid the snake and try not to get clobbered with fresh fruit. Sounds like real life...

SAT This is a powerful, menu driven satellite data downlink terminal, as discussed in the December 1986 edition of Computing Now!.

SCAV This is a great program for people who buy economical floppy disks and just about everyone else who can't afford a clean room for their PCs. It cruises through one's disks locking out bad sectors and restores previously 'fried' disks to usefulness.

SimCGA The utility does an astoundingly good job of making a Hercules graphics card behave like a colour graphics adapter. It will let you run most CGA software.

STUFFIT Stuffit is a disk management utility which stuffs files into the inner tracks of a floppy disk, allowing the outer tracks to be used for work space. This improves the disk access times and the reliability of mostly full disks considerably.

\$19.95

VOLUME 20

ARTIFICIAL ART generates an ever changing graphic image on your PC — with accompanying sound. While it may seem a bit pedestrian, it's a gas to watch. Requires a colour graphics adapter.

AsEasy This is a public domain spreadsheet package, very similar in its abilities to the more popular functions of Lotus 1-2-3. Unlike Lotus, it doesn't cost anything and it isn't copy protected.

ASYNCR This is an assembler file which creates a device driver to make the PC's serial ports behave as they should, with interrupt driven buffered inputs and outputs. This is a programmer's delight. Requires MASM to use.

ChessII This is one of the best chess programs yet devised for the PC. Aside from being small and fast, it lets you physically pick up the pieces and move them rather than entering board co-ordinates. Plays an evil game, too.

HAUNT This is a haunted house adventure game. You wander around looking for the mysterious pumpkin man while picking up things, encountering ghosts and, if you're not careful, getting busted for shoplifting.

LPTX The most flexible printer redirection program imaginable, this thing lets you set up virtual printers, that is, disk files to capture the output of things that think they're printing. Includes both executable and source files.

PITFALL This is a supremely clever ASCII game. Aside from being an absolutely superb game in itself, it's a clever use of the PC's screen. You get to pilot a spaceship down a winding, rather nasty pit. More fun than being beamed into a supernova.

RAMDISK Once you've installed a normal RAM disk, it's there for the duration. This one allows you to change the size of the disk on the fly, or blow it away all together, without having to reboot anything.

ZAPDRAW This is the C source code for the Graphics in C article from the January 1986 edition of Computing Now!. It creates a general purpose high speed PC graphics library, suitable for use on both the colour card and the Hercules board. Requires Lattice C or something similar.

\$19.95

VOLUME 21

CACHE A disk cache program allows one to vastly speed up the disk access of a PC by stashing frequently used sectors in memory. This public domain cache program is extremely fast and fairly intelligent about which bits of oxide it retains.

COREWARS Perhaps the first program to truly embody the spirit of the phrase "computer game", Corewars pits two programs against each other. The object of the game is to crash the other code.

EMACS This is the latest word in well-executed programmer's text editors. It has multiple windows, macros and will even create a DOS shell for you so that you can skip out for a while to execute another task. Requires NANSISYS (see below).

MTS lets you run two applications, flipping back and forth between them at the stab of a key. This is the first one of these things we've seen that's bug-free.

VIEW This is the fastest full screen file browser in creation. It allows you to page back and forth through a file — it's much slicker than the DOS "TYPE" command. Requires NANSISYS (see below).

NANSISYS A replacement of ANSISYS, the improvements in the performance of your system that ANSI can produce are almost god-like. It includes a high speed screen driver and additional escape sequence screen handlers.

MIDIzap Figuring out the secret codes that drive some of the more sophisticated MIDI instruments is a lot easier if you have something to send and receive them with. This little

MIDI debugger runs with the popular ROland MPU-401.

SHELL This is a command.com replacement that implements a UNIX-like environment. It supports many features that DOS would like to have, and a much tighter command structure.

MUSIC SYSTEM This is a pair of programs which allow you to edit and play three voice music on the PC. These programs are not compatible with PC/ATs.

DEV This is a tiny utility that will locate the device drivers in your system's memory. It includes the assembly language source code.

\$19.95

VOLUME 22

CALENDAR This program prints up a calendar for any month in the twentieth century. It's very useful if you want to know which days people were being idle on in 1921, for example.

DFA This is a strange disk accelerator program which attempts to anticipate which sectors your software will call for and fetch them when the computer isn't busy. It can speed up some programs quite noticeably.

FSDEBUG lets you scroll forward and backward through a disassembly, set breakpoints, trace code and so on, all with a full screen display.

GRAB.ASM The source code for the graphics grab program from the March 1987 issue of Computing Now!. Requires MASM to assemble.

SCROLL This is a resident scroll lock key enhancement. It's not all that exciting, but, then at 247 bytes, it's not all that big either.

SIDEWAYS This program lets you print awkward-sized documents sideways on an Epson printer.

PLAYSONG This is the source code for the linkable interrupt driven music playing package from the March 1987 issue of Computing Now!. It also includes the MUSIC.C demonstration program. Requires MASM to assemble and a C compiler to deal with the demo.

ZAPDRAW2 This is the C language source file and updated header file for the text and graphics module from the February 1987 edition of Computing Now!. It embodies several significant enhancements over the published version, including a writing speed increase of about 10 times. Requires ZAP 1.C from our Volume 20 disk and a C compiler.

PINBALL2 If you wasted a meaningful part of your life on the pinball game on our Volume 7 disk, this one will help you ruin what's left of it. It's the fastest, most colourful, weirdest pinball program to date.

MACSHOW This program allows you to look at Macintosh MacPaint image files on a PC. It will also print them and convert them to PC compatible bit maps. Several sample pictures are included. Requires a colour card.

WILLY THE WORM This is a fast graphic game in which you try to get Willy the Worm home. It's extremely strange.

\$19.95

VOLUME 23

ARCE A really tiny archive utility, this thing will extract members from ARC files without tying up half a disk for itself.

BABY An extremely warped game, this thing is engaging and fairly challenging none the less. It involves catching babies who are leaping out of a burning building.

CHMOD This is a useful utility for reading and changing the bits in a DOS mode flag.

CITYDESK This is an elegant fancy printing program that allows you to do some desktop publishing functions with a dot matrix printer.

DOG A disk organizer, Dog will defragment the files on your disks to make them quicker to access.

FPR This is a printing program written in C. It's not compiled — you can change it to meet your needs. Requires a C compiler.

THRILL There is little to say about this program. It's a beautiful example of high resolution PC graphics, and was too good to ignore, even if it was wholly useless. It's also a bit naughty.

MIDI-IO This is the source file for the interrupt driven MIDI communication module from the April 1987 edition of Computing Now!. Requires MASM to assemble and a language compiler to use — preferably C.

PC-WRITE The latest version of this phenomenal word processor, this thing is enough to turn you off any other word processing package on the planet.

will tell you where it is.

ASC This is a memory resident utility that pops up a window with an ASCII character chart.

ATTR This utility lets you meddle with the attribute bit of your files.

BAC This is a disk backup utility that is much less frightening than the one that comes with DOS.

BACKSRL This recalls stuff that has scrolled off your screen. It's neat if you can't seem to reach the NumLock key in time.

CAT This is a collection of disk utilities in one program.

CLOCK One of the nicest clocks we've seen, this has a built in alarm function among other things.

COVER This is a sorted disk directory that prints out all the files on a floppy in a form suitable for sticking to the sleeve.

CWEEP This is a menu driven file mover — saves typing the word COPY over and over again.

DDIR Yet another directory utility, this does a two column directory similar to the regular single column DOS version.

DELZ This wipes out files so they can never come back — kills the sectors as well as the directory entry.

DISKCAN This one checks your disks for bad sectors — get 'em before they get you.

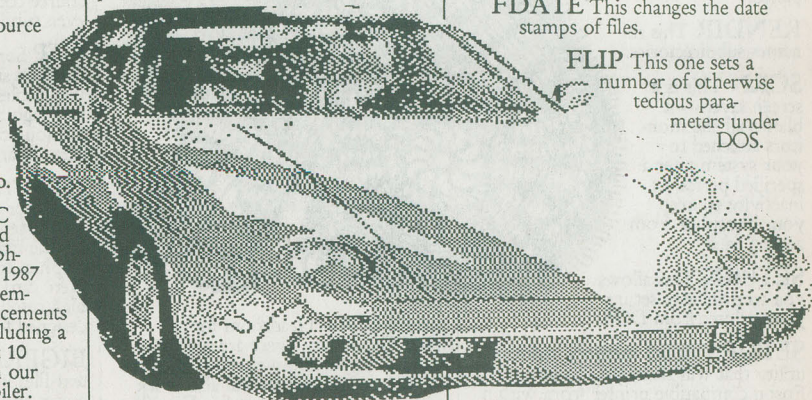
DOORS This lets you flip between multiple monitors without rebooting your system.

EQUIP This program tells you what hardware your system thinks it has — often providing you with the answer to many software problems.

FASTDISK If your floppies seem a bit tedious, you might want to zap 'em with this speed up program.

FDATE This changes the date stamps of files.

FLIP This one sets a number of otherwise tedious parameters under DOS.



EDWIN This is a decent windowing program editor written in Turbo Pascal. It's not terribly fancy, but it's fast and very much like WordStar.

\$29.95 (2 disk set)

VOLUME 24

AC This is a small area code program — give it a three digit area code and it

FREE This returns the amount of free space on a disk without having to free the whole directory scroll by.

GERM This is a memory resident interrupt driven communications terminal.

IBMSHELL This allows you to fool your system into loading COMMAND.COM from other places.

KBBUFF This is a keyboard buffer extender. No home should be without one.

KEYFAKE This allows you to "stuff" keyboard characters into an application to get past tedious introductory screens and menus.

LC This counts the number of lines in a text file.

LOCATE This scans through subdirectories, checking all the files for specific text strings.

LOCK This is a file encryptor. Also includes UNLOCK.

MOVE This moves files between subdirectories with less typing than COPY would entail.

NDOSEDIT An updated version of regular DOSEDIT, this is a resident DOS command line editor that actually makes DOS decent to work with. Indispensable.

NO This is a strange little wild card exception thing. It allows you to create more complex file specifications than does DOS all by itself.

NPAD This is a simple memory resident node pad.

PCUTIL This is a collection of add-ons to DOS.

PINHEAD This is the printing press program from the June 1987 edition of Computing Now! It can get up to 16 kilobytes of text on one page. Includes the C source code. — works with Epson compatible printers.

POPCAL This is a memory resident utility which will bring up any month of any year you like.

PR This is a handy formatted printing utility.

PUSHDIR Primarily used in batch files, this allows you to change subdirectories, do something and then return to the previous directory.

REBEEP A replacement for PAUSE, this is a noisy batch file utility to attract attention when a task has been completed.

RENDIR This renames subdirectories.

SCRN This is a screen saver — it blanks all the monitors attached to your system after a specified period of inactivity to keep your phosphor from getting fried.

SETPRN This allows you to painlessly set up your printer from DOS.

SETUP This is a memory resident utility that will allow you to set up an Epson compatible printer from within any application.

SIZE This returns the number of allocation clusters a file occupies on the disk.

SOUND This makes weird noises to attract attention from within a batch file.

SP This is a really nice little print spooler.

SWEEP This allows you to execute a 4 command in every subdirectory on your disk.

UNDEL This recovers accidentally deleted files. You may not need it now but you sure will sooner or later.

VDL This requests verification before it deletes files so you won't need UNDEL quite as often.

VOLSER Changes the volume name of a disk.

WAITN This pauses for a specified time while executing a batch file.

WHEREIS This finds files in subdirectories. It includes the C source code from the June 1987 edition of Computing Now!

XDEL This is a menu-driven file deletion utility.

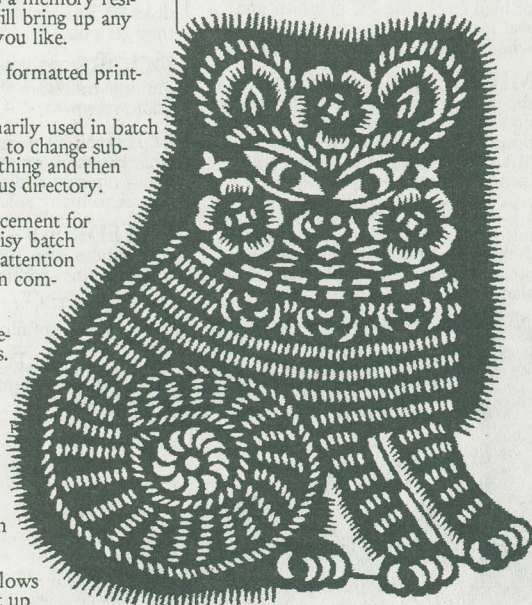
\$19.95

VOLUME 25

VMAC4 This little program allows PC users with Hercules compatible cards — or ATI multiple monitor boards — to look at MacPaint pictures. The Herc card has a more usable aspect ratio than the colour card, and the images look pretty slick.

PINBALL3 The weirdest pinball game we've encountered thus far, this thing will zap your brain if you play it late at night.

MAXHEAD This is a MacPaint



picture of Max Headroom for VMAC4, above. There are several more — rather more exotic — pictures on Volume 24, which will also work with VMAC4. Likewise, this file will work with the MacShow colour card program on the disk, which can be used to convert it for use in other PC graphic software.

SPKR A device driver, this little beast allows you to make the PC's speaker play music in a very elegant, program independent way. It's suitable for use with BASIC, C, Turbo Pascal, assembler and even just from DOS.

RESQ can recover erased files and, more important, it can find text that you've lost in memory due to a

software crash and get it back into a file. It's indispensable.

IT The "Ideal Terminal" is a telecommunications terminal package which emulates several professional mainframe style hardware terminals. It also handles XMODEM and KERMIT file transfers, making it a much less freaky replacement for the likes of QMODEM and CrossTalk.

RIGHT HAND MAN is a sort of enhanced public domain SideKick. It provides all sorts of pop-up utilities including an ASCII table, a really powerful calculator, a DOS shell and several note pads. It also handles keyboard macros.

SLOWDOWN A lot of software — mostly games — which has been written to run normally on a PC switches into maximum overdrive on an AT or even a fast PC. This usually makes it useless. The slowdown program allows you to bring the speed of such a machine back down to sub-light levels for these occasions.

\$19.95

VOLUME 26

AWS Programs that turn WordStar into ASCII abound, but this one turns ASCII back into WordStar. Let those high bits roll.

BADCLUST This program finds the bad clusters on cheap disks, preventing them from killing your data. If you must use low rent oxide, use it carefully.

CHEAPFMT Like BADCLUST, above, this program makes your life less freaky if you use cheap disks. It formats them very carefully, looking for unusable sectors.

CCC A C language programmer's dream, this is a "pretty print" program, that actually draws nesting loop and structure diagrams beside the source code it lists. It makes spotting even subtle bugs effortless.

CTP Something of a mutated fusion between snake and space invaders, this is a ruthlessly fast arcade game in first rate high resolution graphics. Requires a colour card or HGC, below, and a Herc board.

HGC This is the first colour card simulator for a Hercules board that really seems to have its act together for the majority of colour card graphics software. Run it and your Herc card will display colour card high resolution graphics as if it was designed for the task.

BIGPRINT This program prints text files in very large characters. It requires an Epson compatible printer.

MBS This is one of the nicer fractal programs we've encountered, as well as being one of the faster ones. It runs on a colour card, or on a Herc board with HGC, above.

MOUSE This is the source code for the linkable MOUSE driver, as seen in the July 1987 edition of Computing Now! It requires MASM to assemble and a C compiler to use.

PCRR This is one of the most interesting programs we've yet en-

countered. It simulates a railroad in high resolution graphics. You can lay out your railroad, equip it with multiple trains and make the whole party go. Requires a colour card or HGC, above and a Hercules board.

TASKER This is the most elaborate multitasking system yet devised for the PC. Install up to nine variable sized partitions, with a program running in each, and pop between them instantly.

WINDOW This is the source code for the C language window manager from the July 1987 edition of Computing Now! Written in Lattice C.

\$19.95

VOLUME 27

DECEIVE This is a resident program to be used if your boss likes to creep up behind you when you're supposed to be working. At the touch of a key your PacMan screen can be replaced by WordStar, Lotus or any other serious application until the powers that be are satisfied and play can resume.

DPATH Allows the opening and creating of files to be handled with a path, just as the running of programs is under DOS with the PATH command. This is the gift of the gods to programs that can't find their overlays and configuration files.

HXC A sophisticated hexadecimal calculator, this program will keep you from damaging your hands by trying to glue on four extra fingers.

IOMON This is a resident utility which monitors the disk I/O of your system and lets you see what the drives are doing. It's great for spotting the causes of system errors.

TREECOPY This is the best... and fastest... tree copy utility we've encountered to date. It will copy an entire subdirectory and all of its included subsubdirectories into another tree.

TREEDL This program will wipe out a whole subdirectory and any subdirectories in it with one command. Mass slaughter... what fun!

TREESIZE This program tells you how much space is occupied by the aggregate contents of a subdirectory.

VRAM This amazing bit of work is for people with programs that want to see a Lotus-Intel AboveBoard memory card...if they lack one. It allows up to eight megabytes of hard drive space pretending to be extended memory...sort of a reverse RAM drive.

LQPRINT is a nice print enhancement utility that works with many word processors and printers. It includes a wide selection of very well done fonts.

ZANSI Another replacement for ANSISYS, this one increases your console printing speed by almost fifty percent without sacrificing any of the commonly used ANSISYS functions.

CYLON This makes your cursor go strange... deliberately. Requires an EGA card.

EGARIDS The best asteroids

game ever written for the PC... when those rocks come at you, pray to the cosmic gods. Requires an EGA card.

KC-PAL An EGA palette editor and librarian. Comes with lots of support utilities and toys. Not surprisingly, it requires an EGA card.

NEWFONT Replace the austere, depressingly corporate IBM font of your PC with damn near anything you can think of. Several fonts are included. The screen interface is seamless, and the results can be extremely pleasing. Requires an EGA card.

\$19.95

VOLUME 28

ASTROLAB This is a very sophisticated program for working out the conjunction of the planets for any day in history. It's not much use if you believe in a flat earth, but handy for horoscopes.

BASERES Yet another resident utility, this thing will accept numbers in any base and show them to you in all the other commonly used notations. In other words, it will convert decimal to hex and back again—great for people with only ten fingers.

BREAKON This is a utility to make just about any program exitable with control-break. It has multiple levels of urgency—three hits gets you out of anything short of the end of civilization as we know it. Assembler source included.

CROSSWRD If you've ever wanted to generate your own crossword puzzles, this is the code for you. Fill it full of words and it finds places for them—keeps track of the clues, too.

DIMMER The smallest screen blander yet—two hundred and seventy one bytes.

EPSONISM Even people with laser printers occasionally have to deal with plebes. This program is a DOS filter to make a PostScript printer behave like an Epson.

FASTBIOS This is a pair of programs which will extend your keyboard buffer—without hanging your system—and increase the speed of your screen dramatically.

FREERAM This will tell you the truth about how much useable memory is available to your programs.

LASERGRID This is a rather good ASCII game. Place your bets and hope the aliens leave you alone.

VMUSIC This is a small three voice music player which handles its scores in BASIC music notation. Comes with several songs, and you can easily create your own tunes with a text editor.

IDCKEYS This is an assembly language program to set up the function key redefinitions under ANSI.SYS. It's great if you like to have keyboard macros under DOS without a keyboard redefinition program installed. Requires an assembler to use.

IDCKILL This will go through an entire hard drive—including all your

subdirectories—and kill files that match a given specification. A bit nasty if you use it improperly, but great, say, for snuffing BAK files.

LW86 This is an extensive pop up reference card for assembly language programmers. It includes explanations of the op codes, what the assembler directives do and so on, all at the touch of control shift.

SPACE Find out how much useable space is on your hard drive instantly. Includes assembly language source.

YESNO A really useful thing to create complex interactive batch files, this little program returns an error level code basic on the ASCII value of a key press. Assembly source included.

\$19.95

VOLUME 29

INSTACALC is a memory resident spreadsheet. It may not be Lotus or Excel, but it's amazingly powerful considering that it lives in an alternate key combination. Includes a sophisticated macro facility.

ALTER allows you to change the attributes of a file... including the time and the date.

CALENDAR is a sophisticated desk calendar which can be made memory resident if you want it to be. It uses data files which allow you to have it remind you of things.

COVER prints disk directories suitable for sticking into the sleeves of your disks... the nicest such program we've encountered. Requires an Epson compatible printer, patchable with DEBUG for other printers.

DISKLITE is a tiny bit of code which shows you when one of your drives is running. Not much use for floppies, this, but great for RAM disks and AT style internal hard drives.

DISKUTIL is a poor man's Norton utility. It will walk you through simple disk level functions, including FAT table fix ups and file unerasure.

MELT clears the screen, dramatically.

MONSTER a memory resident DOS monitor. Check out what your programs do one INT 21 call at a time.

THEGRIN is the most sophisticated MacPaint picture viewer yet. It allows you to stretch and compress images, zoom in and out and generally hack their bits to bits. It also prints them.

TMAP is a clever TSR program mapper which is itself memory resident. It's superb for finding gorges caused by interacting resident programs.

VARISLOW is a variable speed control for AT type computers. It lets you crank the clock down to play games at their normal speeds. However, you can do it interactively, rather than from a command line.

WATERFALL is a fabulous MacPaint picture of an Escher drawing, suitable for use with THEGRIN or any other MacPaint reader.

CHINASEA is a James Clavell novel in a disk file. In this game you get to be a trader in the far east. Try to prosper without getting knifed.

TURBO C PATCHES

is a collection of patches to fix some of the bugs in the early releases of Borland's Turbo C. If you're going to compile at warp speed you'd better have one of these.

\$19.95

VOLUME 30

386BUG Some 80386 chips don't

work quite right. They have problems with integer multiplication, which can cause some software to behave unpredictably. This Little program spots the duds... it's essential if you're thinking about buying a 386 machine. Includes source code.

MASM-MAC This is a collection of MASM assembler macros to make BIOS, DOS and 8087 interfacing a lot easier. Requires MASM to use.

8X6 installs a really tiny screen font on an EGA card. You can get about four times the usual amount of text on your screen with this if you run applications which support it.

AT is a little time bomb program. It will hide in memory and run applications at specific times and dates without any attention. Allows for queuing up several tasks.

BACHMIN is a three part Bach minuet in BASIC... quite the trick.

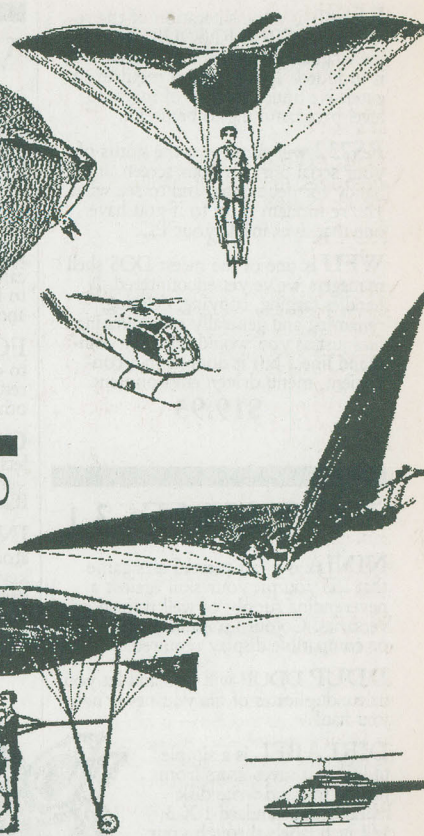
CAT is a small sorted directory program. While hardly high tech, it is a useful replacement for DIR.

CAVERNS is a fast graphic arcade game. It looks a bit simplistic but it will surprise you when you get into it. Wants a CGA card.

CMOS is a pair of simple programs which read the contents of an AT's CMOS memory into a disk file and then restore it. This is great for changing batteries, of course, and also for those systems with funky memory which require frequent setting up.

DIRNOTES allows you to attach short, one line comments to the directory entries on your disks.

PRTSCEGA is a program to make the PrtSc function work properly for EGA cards, allowing you to once again dump screens to your printer. Versions are included for a stock Epson FX-80 and for the Tandy DMP200. In addition, the source code comes with it, so you can hack a driver up for your specific printer.



EDISK allows you to put a RAM disk in the space between your normal system memory and your screen buffer, using this otherwise wasted space for something practical. It requires that you have memory in there, of course... many RAM cards will do.

EMC is an extended memory cache. It allows you to use LIM memory for a disk cache, speeding up your disk accesses without robbing your system of any main memory.

GDIR is a sorted directory program with uses the Hercules card's graphics mode to put forty-three lines of listings on the tube at once. It's very slick.

HELP is a slick little DOS help program which can be called up any time you need something about the PC explained to you.

THRASHER is a splendid system to find out the optimum setting for the BUFFERS line in your CONFIG.SYS file. It can speed up your disk accesses while actually freeing up a bit of memory.

MCSCOOP is the executable version of the MacPaint file reader in the Jan. 1988 edition of Computing Now! It also prints picture files... to PostScript, LaserJet+ and Epson printers.

LDRES is a system to make somewhat standard COM files into memory resident utilities, or TSRs. Please note that while full documentation is included with this thing, it's still a bit technical and you'll have to be a moderately decent hacker to make something come of it.

NOREBOOT will disable the Ctrl-Alt-Del reboot of your system. Source code is included.

RES86 is a transliteration of the redoubtable CP/M RESOURCE machine language disassembler. Source code is included. This program requires an extensive understanding of machine level programming to be useful.

RS232 will show you the status of your serial port on your screen. It's handy for debugging, and to see what you're modem is up to if you have one that lives inside your PC.

WFU is one of the nicest DOS shell managers we've yet encountered. It handles tagging, copying, deleting, renaming and generally manipulating files just as you would with the command line... but it does so in a convenient, menu driven environment.

\$19.95

VOLUME 31

NINJA is a fast martial arts game that lets you pit your skill against a neverending supply of well trained adversaries. Colour Graphics Card, EGA or compatible display required.

DDUP DDUP will find and let you delete duplicates of file you never new you had!

DIRLABEL is a simple utility that saves users from having to hand-write disk labels. Feed standard 1 X 3 1/2 inch labels through your printer and start DIRLABELing your floppies.

MADNESS If you thought you were going crazy, you haven't played Madness. MADNESS is an adventure game for the mind. Enter a land of shadows and mirrors, where reality is little more than a hazy concept.

PM is a handy co-resident phone message utility. Just pop PM onto your screen and enter the particulars of each call. PM inserts the correct date and time and appends each message to an ASCII text file that can be printed later.

RUSHHR is one of the strangest games ever created. Play traffic computer by juggling the timing of a series of traffic lights in a busy downtown core. You control the number of cars that are able to get through each light.

SPEED performs a detailed system speed test - similar to the "SI" test provided on the Norton Utilities, only better. SPEED shows you speed statistics for a host of register and memory operations such as arithmetic calculations and block memory reads and writes.

FREECELL This is an unusual solitaire game. Great graphics!

HDSENTRY is a resident utility that intercepts destructive calls to hard drives. Run HDSENTRY before trying out public domain software of dubious origin. It tries to prevent Trojan software from destroying the data on your hard drive.

\$19.95

VOLUME 32

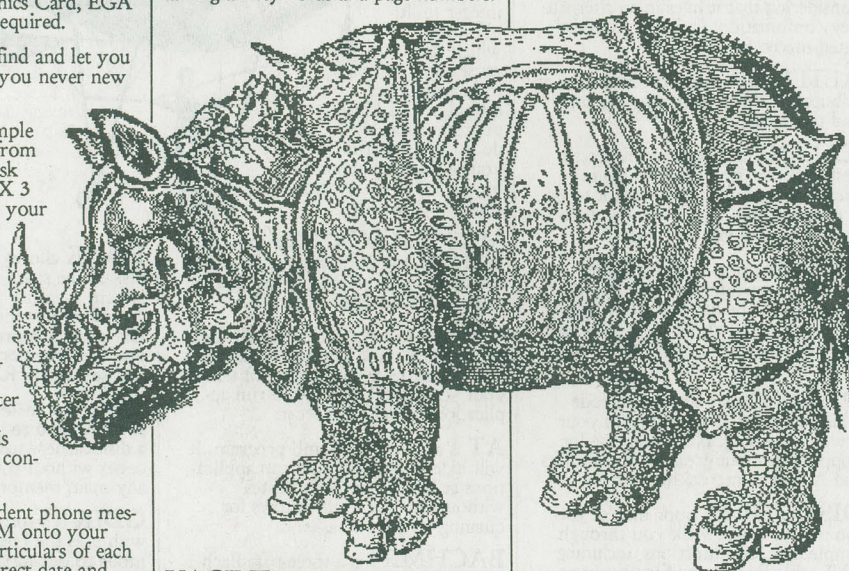
ARCTOOLS is a front-end menu utility for the popular PKXARC/PK-ARC archiving utility (available on SuperDisk 1). ARCTOOLS makes it easy to view and extract archived files.

CMPDIR is a simple utility that simplifies comparing files in different subdirectories and drives. CMPDIR can be a real timesaver when you need to identify files with the same name and different date/time stamps.

FCU is a financial calculator. Use it to quickly calculate interest, rates of return, loan amortizations and many other common financial calculations.

CARSIGN is a silly program that lets you create diamond-shaped "carsigns". Requires an Epson FX/MX or IBM Graphics compatible printer.

INDEXER is a flexible index generator. Create a text file with all keywords required in the index and indexer will generate an index file containing all keywords and page numbers.



VACINE is a utility designed to prevent "virus" software from infecting your hard drive and DOS disks. VACINE can tell you if the COM-MAND.COM and DOS system files have been tampered with.

FREE is a memory utility which reports on how much RAM is available in your system. This one also reports on Extended Memory (above 1024K).

PRUFREAD is a specialized file browser designed to speed proofreading. A highlighted bar remains stationary in the middle of the text screen, making it easy to focus on one line at a time in the text.

FKEYMAP is a utility for printing Function Key templates (for keyboards with function keys vertically oriented on the left-hand side) Great for new users. FKEYMAP includes templates for Word Perfect and Lotus 1-2-3 version 1A.

APRIL is one of the strangest "April Fools" software pranks ever created. Slip it into a friend's AUTOEXEC-BAT file and see what happens. Completely harmless fun. Colour graphics

card required. Also works with SIMCGA CGA simulation utility.

DVICEMAP is the most comprehensive utility yet devised to map memory locations of DOS system devices. This one also shows the order in which devices have been loaded, attribute words and interrupt locations.

\$19.95

VOLUME 33

READRITE is a co-resident "readability checker". Based on a formula developed by Rudolph Flesch, READRITE can be called up to analyze text. It will provide a readability index that relates syllables per word and words per sentence.

SPACEWAR is a fantastic space battle simulation. It comes in both CGA and Hercules versions and has stunning graphics and fast play. Loads of options!

MFRACT is a simple fractal gener-

ator that can display an endless variety of "mountain" fractals. CGA required.

TCKILL is a file deletion program with a twist. After files have been OK'ed for deletion TCKILL will toss them into the trash!

TETRIS is a wonderful game! This is the original version that was created in Russia. It is best described as an "action puzzle" and it will challenge your imagination and your reflexes for hours at a time.

TOGGLE is a useful little utility that lets you control the status of your keyboards NUMLOCK, CAPS LOCK and SCROLL LOCK keys from DOS.

STOPCLOCK is a handy little stopwatch that prints a huge digital display one your screen. Just the thing for the office olympics or for the occasional impromptu benchmark.

LIFE is a new version of a classic computer game. This one comes with complete on-line instructions and includes a detailed history of the game.

BUFFIT is a nice DOS buffer utility that lets you scroll through DOS screens that have disappeared from view.

ELTYPE is a simple typing test program for training and evaluating keyboard virtuosos. It provides real-time statistics on speed and accuracy.

\$19.95

VOLUME 34

DA is a multi-featured directory sorting utility that allows you to arrange DOS "dir" file listings in any order you please...program files at the top, data files at the bottom, yogurt on top, fruit on the bottom, you name it.

IAU is an invaluable hard-disk Interleave Adjustment Utility. It allows you to reset the "interleave" value of your disk, without disturbing your data. If your drive was set up by uncaring, unfeeling mechanics at the dealership, chances are you can double its response speed.

HDTEST is a very complete hard disk testing system. It writes and reads several types of test patterns on every sector of your drive, and will find subtle data weaknesses to faint for DOS to notice. Data is removed from suspect sectors, and the sectors marked as bad, soDOS will avoid them in future.

G uses a little data file to store "nicknames" for commonly-used directory paths. By running G followed by the nickname, you can immediately switch to the desired directory - no matter how distant it may be in terms of DOS path specs.

FLUSHOT is one of the most respected anti-viral protection systems ever devised. The program provides checksum protection of system files, immediate warning of any programs that try to leave portions of themselves behind in memory, and warnings any time a program attempts to do direct writing to your hard disk. There are numerous other options, plus very extensive documentation.

\$19.95

DBWP is a dBase III to Word Per-

VOLUME 35

SCANNER is a goldmine of information for anyone interested in broadcasts you can't get on an AM/FM Walkman. **SCANNER** provides Canadian, American and world-wide (where applicable) frequencies for aviation, marine, NASA, news, weather, railroad, taxi and myriad other services.

BCALC41 is a Big **CALC**ulator which will delight anyone who requires miles of precision for calculations. **BCALC41** can calculate pi (or any figure) up to 1075 digits with blinding speed, emulates a Hewlett-Packard calculator with numerous functions, ten memory and four stack registers, and is accompanied by its C source code.

CWC is a remarkably thorough crossword puzzle designing tool whose output actually looks like a crossword puzzle, clues and all. Save and load your puzzles to disk, and edit or print them out at your leisure. Fair warning: the demo puzzle's a killer. Needs an Epson-compatible printer, but any video card will do.

FORMATQ is a practical ... and speedy ... solution to the nightmare of formatting an entire box of diskettes. **FORMATQ** easily handles all IBM PC and PS/2 disk formats. Though designed to format many disks in one sitting, it can format a lone 360K data disk in 41 seconds flat.

ANADISK is a comprehensive floppy disk aid which, among other things, will copy most disks. **DISKCOPY** has problems with, allows editing of sectors or files in hexadecimal or text, and will endeavor to fix corrupted FATs and remap bad disk sectors. **ANADISK** reads most combinations of IBM disk formats, and can even read Atari ST 3.5" diskettes (this assumes you have an AT with a 3.5" drive) ...

UNERASER will resurrect accidentally erased files, providing they haven't been written over by other data. This small but vital program is extremely handy should you **DEL** one file too many.

\$19.95

VOLUME 36

FINANCE1 was written to keep track of the home chequing account, and allows both known and estimated (what if?) entries. Charts may optionally be generated of annual income and expenditures.

FORM275 uses IBM's graphics characters and comprehensive editing functions to make designing forms as easy as drawing them on the screen. It comes in handy for drawing street maps and decorative borders, too. Forms may be printed on printers which have the IBM graphics set in ROM, or saved for importing into database programs.

TELEPORT is a snazzy bit of

RAM-resident coding which enables you to capture, edit, merge and save up to four text windows simultaneously with a monochrome, CGA or EGA card.

ONISIDE will take spreadsheets saved in ASCII format and print them sideways on an Epson-compatible printer. While that's not an original concept, **ONISIDE** allows you to choose from seven inherent fonts, which may be magnified in two directions. You may also elect to modify the available fonts or fashion your own. **ONISIDE** can print lengthy sheets, and will use either a monochrome or colour video card.

WS161 actually isn't another WordStar upgrade, but an exercise in surviving in the wild. Find food and shelter in a forest that has little interest in your leaving it alive. CGA card required. Surprisingly addictive, it beats blasting acquaintances with paintballs anyway.

\$19.95

VOLUME 37

OPTIKS is a welcome solution to the amazing proliferation of varied ... and incompatible ... graphics formats vying to become the de facto standard. **OPTIKS** can read and

display .RLE, .GIF, .MAC, .PIC and a host of other graphics files. Once loaded, these files may be manipulated in every conceivable fashion. **OPTIKS** accepts images from some scanners, outputs to laser and dot-matrix printers and supports EMS memory, VGA, EGA, CGA and Hercules cards.

M2COM is a short program that turns readmac files into .COM files, thus eliminating the need for separate display programs. **M2COM** leaves the original readmac as is, and produces a .COM file of the same length.

GARFIELD is a fat, bug-eyed cat who, in this readmac graphic file, has no respect for computers. Aside from being cute, **GARFIELD** will give you something to read into **OPTIKS** and **M2COM**.

MAHJONG hails from Australia, though the game's roots are in China. Professionally implemented with three levels of play, its graphics alone will entice the uninitiated. Experienced players will appreciate never again losing a tile after a particularly frenzied game. Requires a colour graphics adaptor, though a colour monitor is optional.

PLAYLRN is a collection of learning games for toddlers 18 months to roughly four years old. Through use of sound and colour, future programmers are taught to recognise shapes, letters, numbers and simple words.

\$19.95



VOLUME 38

CALENDAR is a perpetual calendar running from the middle of the sixteenth century up until way past the age of Star Trek. This program will show you when important dates fall in the years of your choice as well.

CPM2DOS will actually read files from the disks of most CPM systems onto your PC. Unlike commercial packages which purport to do the same thing, it includes a facility for creating custom formats. It's a perfect companion to **Z80MU** on Volume 11.

GCAP is the ultimate graphics screen capture. This resident utility will create **GEM/IMG** paint files from anything on your tube, suitable for use with Ventura, amongst others... an essential gadget for desktop publishing. Works with EGA monochrome, CGA and Herc cards.

MACSCOOP is an updated version of the popular MacPaint file reader and features support for Epson FX, Hewlett-Packard LaserJet+ and PostScript printers and for EGA, CGA and Hercules display cards. It will let you look at and print any MacPaint image file. We've included a few to get you started.

GEMSCOOP is very much like **MacScop**, above, and has the same features for reading and printing **GEM/IMG** paint files. This is a really handy tool for desktop publishing.

MAC2IMG converts MacPaint to **GEM/IMG** paint files for use with Ventura, among others, allowing you to access megabytes of public domain clip art. Handy for use with **IMG CUT**, **GemScop** and **Address** also in this collection.

MEMO drives a PostScript device to generate truly eye catching memos. It accepts raw text or WordStar files and prints them sophisticatedly.

FONTS is a collection of our favourite EGA font programs, which will reduce the screen characters of any EGA compatible display adapter. Included are Script, Computer, Future and others. Also included is **EGAFONT** allowing you to create your own font programs.

ADDRESS is a vastly enhanced resident envelope addressing program which allows for custom printer configurations and either standing text or graphics of your choosing for the return address.

VCHECK will do a CRC check of the sensitive system files on your hard drive each time you boot your machine, ensuring that none of them have been infected with viruses.

IMG CUT extracts fragments of **GEM/IMG** paint files for use with desktop publishing and other applications which use this image file format. You can pre-crop pictures to save disk space and time and can also make graphics files for **ADDRESS**, also in this collection.

PINPRESS prints text very, very small on an Epson FX-80 compatible printer and allows you to cram up to sixteen kilobytes of text in two columns on a single page and keep it readable.

SMALL is the PinPress for laser printers. This thing will print about four standard pages of text on a single sheet of paper... rather small, of course. Works with any PostScript device.

\$19.95

VOLUME 39

BOOM is a program to display fireworks on your screen. You probably don't think you need one of these... most likely true, but it's fun to watch. Requires a CGA or EGA card.

COLORDIR is a very slick... and exceedingly fast... sorted directory program which uses screen colours to make large directory listings easier to out at a glance. A colour monitor, while by no means essential, is highly recommended.

DIGCLOCK is a huge screen clock which reads out in seven segment numerals. Easily read from across the room, or across the street with a good telescope.

DISPINFO is a C source file for programmers. It's a foolproof routine to allow your code to figure out what sort of video card is in the computer it's running on.

ED is another C source file, this one for the standard unix ed text editor. It has been reworked to compile under Turbo C, and will serve nicely as the basis for a word processor if you want to write your own.

EGA2RAM runs the BIOS of your EGA card from fast RAM rather than slow ROM. It speeds up your screen quite noticeably with no snow or other drawbacks. Requires an EGA card, ASM source code included.

FASTGIF is a GIF image file reader. GIF files are glorious colour picture files which must be seen to be really appreciated. We've included a GIF file of a mandrill so you can see what they're up to. Requires an EGA or VGA card.

HP-SLASH reduces the size of LaserJet soft fonts... and their resultant download time... by allowing you to selectively remove unused characters from them. This is an essential tool for anyone using a LaserJet compatible printer, especially with desktop publishing.

MAXI.EXE is the answer to every "insufficient disk space" message in creation. It formats up a normal double density floppy to hold four hundred and

twenty kilobytes, and a quad density disk to hold almost a megabyte and a half. Our tests indicated that these disks are no less reliable than normal floppies, and can be read in normal PC drives.

PC-POOL is a really well executed pool simulation. The ballistics of the balls is very nearly perfect, and the user interface is well thought out. It's not as gory as killing aliens, but it's better for your karma. Requires a CGA or EGA card.

REMINDER is a memory resident appointment calendar which pops up at the touch of an alternate key. It also features a screen clock which can be enabled or disabled at will.

RN is the best way to move around the subdirectories of a hard drive ever invented. Rather than having to type in complex paths, RN allows you to move around in menu driven comfort.

SAY is the best speech program we've encountered for the PC thus far. It's pretty intelligible, especially considering that it speaks through a speaker the size of a quarter connected to a timer chip. It comes with a host of phrases, including the all but essential "beam me up, Scotty". Good for disturbing your stupor in the morning.

VFM will warm the hearts of Ventura Publisher users. It allows you to add and reorganize fonts for this popular desktop publishing system without any sweat, bother or keying of batch files. No laser should be without one.

MCPY is command line replacement for the DOS COPY command which allows you to copy files to floppies with maximum space efficiency, a prompt to swap floppies when the disk is full and full CRC checking to make sure that what you see is really what you get. DOS, as it turns out, doesn't verify its copies very well even with the verify flag on. This is an essential utility.

\$19.95

VOLUME 40

SQUYNCH is an adventure game created with the Adventure Game Toolkit. Charged by Squeeb II to retrieve his ruby, you'll face various unpleasant obstacles in fulfilling his request. **SQUYNCH** has a sophisti-

cated command parser which accepts complete sentences as valid input.

CRAPS is a realistic representation of the Las Vegas dice game. **CRAPS'** instructions include a thorough description of how the game is played and the odds of various bets paying off. You'll need a colour graphics card and **ANSISYS** in your **CONFIG.SYS** file to play.

PICEM16D allows users of CGA, Hercules and EGA as well as VGA graphics cards to view multi-coloured .GIF, .PIC and .PCX graphic files. Plantronics and AT&T graphics cards are also supported.

ROGER.GIF is a multi-coloured graphic of Roger Rabbit, a cartoon hare of recent cinematic fame. Best viewed on a colour monitor.

EDMAC allows users to edit and (optionally save) readmac graphic files. Good for cleaning up the extra bits inherent in files ported from the Macintosh. **EDMAC** is accompanied by its Pascal source code, and requires a colour graphics card.

OPUS is a readmac of Berke Breathed's Bloom County character in a questionable state of Penguin Lust ...

FOWLPLAY attempts to settle the question of why did the chicken (or turkey) cross the road. Similar to Frogger, this game requires a colour graphics card.

ATALK is a number of humorous digitised sentences which actually sound reasonably clear through your speaker.

\$19.95

VOLUME 41

GALAXY24 is the latest version of the Galaxy word processor. Now equipped with a spelling checker, Galaxy allows the user to work on up to two textfiles at the same time and import text from one to the other. The colours Galaxy uses are user-selectable, and EGA owners may elect to display 43 lines of text instead of the standard 25. Galaxy can use the entire IBM character set, provides ten programmable macros to save you some typing, and will take advantage of a mouse, if you have one. Most popular printers are supported.

PC-TOUCH endeavours to improve your typing skills by recording your accuracy and words per minute as you type in the deep thoughts it throws at you from thinkers great and obscure. In executable form, **PC-TOUCH** comes with its BASIC source code, and allows you to change the quotes to virtually anything you'd like. **PHNWRD10** knows that you've always wanted to know

what your phone number spells out, and is willing to display ... or print ... all 2,187 permutations to help you out. Few of these will actually make sense, but there may be an interesting phrase or three nestled in amongst the resultant cryptograms.

\$19.95

VOLUME 42

FORMATQM is a very, very fast disk formatting program.

FIREWORK blanks the screen after a period of inactivity and shows you fireworks until you do something. Windows is required.

SNAKE is simply the best snake game ever written.

BELL makes the sound of the beep in your computer slick and sophisticated.

CALLTIME will dial up the atomic clock in Ottawa and set your system clock accordingly. A Hayes compatible modem is required.

CASE will change a text file to all upper or all lower case, strip of the WordStar bits and do other useful things.

CDTO provides a simple way to locate files in other subdirectories and the go to their locations.

CLOCK is the biggest resident screen clock in creation.

DDATE is a cursor driven date setup program.

DEV shows you where all the device drivers in your system are.

KTIMER times the execution of any program to the nearest 100th of a second.

LISTFRAG shows you how fragmented your hard drive is, allowing you to decide whether it's worth running a defragmenter program.

NREFRESH slows down the refresh rate of your system memory to increase the speed of your machine.

RAMVIEW is a resident program that lets you pop into a hex and ASCII dump of your system and page through your RAM. Very revealing.

REPEATS locates identical files in a complex hard drive system, allowing you to free up disk space.

SETALARM wakes you up at a predetermined time.

SILENCE more or less totally kills the speaker of your PC.

STEPPDOS allows you to step through the execution of a program one DOS call at a time, with an informative display at each pause.

VTREE2 shows you a map of your system and the sizes of your subdirectories. Great for pruning.

WATZITDO returns information about the multifarious alternate key combinations on the PC.

WF is a very clever wild card find program that searches for files on your hard drive without asterisks or question marks.

WORLDTIM lets you see the time anywhere in the world.

WPHD disables writing to your hard drive temporarily, protecting it from viruses to some extent.

XPANDISK creates a very sophisticated, variable sized RAM disk in expanded memory.

TUNEUP uses your PC's speaker to generate extremely precise pitches for tuning stringed instruments.

FORM generates business forms.

TCAP captures text screens, but makes them into GEM/IMG files

\$19.95

VOLUME 43

MAGMA is a truly weird graphic arcade cum adventure game. Tunnel through the depths of the earth, contact spies and try to assemble all the fragments of your secret document.

BANKER will keep your check-book in balance... as well as anything short of divine intervention can.

FONTFILTER adds special effects to LaserJet softfonts... and does it brilliantly. Included are such effects as drop shadows, enclosing boxes and even blood dripping from each character... Also includes the complete C source code.

READRITE is a real time readability analyzer. A resident program, you can pop it up from within your favourite word processor and get a readability index for the contents of your screen. Very slick.

CALC is the nicest pop up programmer's calculator we've encountered... and it's great for anyone else who has to deal with numbers too. It includes base conversion and other useful functions.

CARDFILE is a little pop up data base program which will keep track of people, places, phone numbers... it even dials your phone through a Hayes compatible modem.

RECORDER will keep track of the frequency of access of the files you use to help you decide how best to use a RAM disk.

BARMENUS compiles and implements Lotus style menus in applications other than Lotus. It's a great toy for die hard 1-2-3 users, and not a bad user interface for the rest of the planet.

SNIPPER is the slickest text cut and paste program we've encountered to date. Copy text from the screen of just about any application into just about any other one. Great for getting spreadsheets into your word processing documents.

SWEEP will execute any command you like in every sub directory of your hard drive.

CONFIG is splendid. It lets you alter the way your CONFIG.SYS file is interpreted by DOS when your system boots up. You can exclude specific drivers at boot up time to free up memory space... no PC should be without it.

Z80XASM has been requested by a number of our users. It's an assembler which runs on a PC compatible system but assembles ASM source code for the Z80 microprocessor. Includes a Z80 machine language monitor as a test file.

HERCSAVE is the most reliable Hercules screen blanker we've come across. Save those green screens.

FSEE is a quick and nasty way to see what LaserJet fonts look like without having to download them to a laser printer... it shows them on the screen of your PC in graphics mode. Handy for use with FONTFILTER, above.

OKSCR is a really elegant way to get reliable screen captures from graphics applications. More to the point, it actually works. Writes to PC Paintbrush compatible files.

VALSPEAK translates English into valley girl talk. Gag me with a spoon.

TED is a very small text editor... two

kilobytes is very small. It's about the easiest little editor in creation for just whipping up a few lines of a batch file or changing a driver in your CONFIG.SYS file. It's also good for program editing.

EGALINES is a collection of tiny utilities which will set your EGA card to different line sizes so you can see what text looks like in the higher resolution modes. Includes 12, 25, 35, 43 and 50 line modes.

EGAITAL puts your EGA screen in italics mode. Not blindly useful, but it's only about a hundred bytes long.

PCXSCOOP is a file reader and printer for PC Paintbrush PCX and PCC files. Let's you check 'em out without loading the whole ZSoft circus. Handy for use with OKSCR, above.

\$19.95

VOLUME 44

BCOPY is one of the cleverest copying programs around. It hides in the background while it's working, so that immediately after issuing a copy command your DOS prompt returns and you're ready for whatever's next. A great little time saver.

BDS is a slick pop up electronic engineer's calculator. It handles things like wavelength, capacitance, radio equations and so on.

CALCQF analyzes your system and figures out how much you can speed things up by changing the refresh rate of your memory without crashing your machine. Then it generates a small COM file to include in your AUTOEXEC file.

JIVE translates any English text into jive.

LUM is a sophisticated sideways printing program which is great for spreadsheets or any application wherein regular paper just isn't wide enough. It supports multiple fonts, effects and so on. Requires an Epson FX-80 compatible printer.

NJFRERAM will show you how much free memory you have from moment to moment up in the upper right corner of your screen. Great for spreadsheet users, amongst others.

ORDER changes the order in which files come off your disk when you type DIR. This allows you to pre-sort your directories, or adjust them in any order you like to make frequently used programs boot more rapidly.

PYRO we've had fireworks programs before... but this is the best. It does EGA fireworks, complete with sound effects, and is truly glorious. Includes C language source code. EGA/VGA card required.

SOT is the son of Tetris, the addictive game from the Soviet Union. This one is even more devious.

STYLIST is an essential tool for any Ventura Publisher user. It allows you to edit, manipulate and print out any style sheet.

TONTO is a SideKick-like program with a host of features, including a clock/calendar for any year since the middle of the sixteenth century, an ASCII chart and a printer setup program.

MR BOSTON is the ultimate bartender. It holds recipes and complete

directions for zillions of mixed drinks... from the common to the delightfully bizarre... and provides you with an outstanding user friendly program to access and even add to the list.

\$19.95

VOLUME 45

POPDOS2 is a pop up DOS shell. You can rename, delete, type and generally meddle with files from within any application. It can save your life when your disk is full and your file hasn't been saved.

CALLFOR is a resident equivalent of those pink message slips that proliferate around offices... just the thing for an overworked receptionist, especially one with bad handwriting. It can be popped up from within a word processor or other application when the phone rings.

CLEARCUT will scan your word processing files and suggest places wherein you've used more complicated wordings than you should have. It helps to simplify your writing and make it easier to read.

CONFMT is a resident disk formatter. It allows you to format floppy disks as a background task while you run normal programs. It's quite a time saver.

FLEES is like Space Invaders on acid. It's blindingly fast, with brilliant graphics and some really bizarre aspects. Requires an EGA or VGA card.

PALMEGA is a computerized palm analysis program. Better than an old lady with a crystal ball, it will tell you how long you'll live, how rich you'll get and whether or not you'll meet a tall, dark stranger who'll try to sell you swamp land in Florida. EGA or VGA card required.

P4UP will print four pages of normal text on a single sheet of paper on most laser and inkjet printers. It has a number of sophisticated formatting features, too.

SHFTPICK is ideal for people with a lot of resident programs on their hard drives. It allows you to hold down the Alt key and bypass loading them when your system boots up.

MDIAL is a memory resident dialer program and phone number data base. Connected to a modem, it allows you to dial voice calls without actually touching a phone.

SMOOTH is the leading edge of text browsing programs. It will smooth scroll back and forth through any text file. This may seem like overkill... well, it is, actually... but it's awfully neat to watch.

VALET is the best DOS shell program we've encountered. It will move, mass copy, delete, rename and generally handle the files on your hard drive in menu driven comfort. It's ideal if you don't like typing in commands.

WIPE totally destroys files on your disk so that they can never, never be restored and looked at again. It's an essential tool if you deal with sensitive data.

YEARCAL creates calendars for any month of any year of the twentieth century. However, it creates more sorts of calendars than you can possibly imagine... in sixteen languages.

\$19.95



VOLUME 46

PAINTER'S APPRENTICE

This is a complete implementation of a MacPaint style paint box program for the PC, equal or superior in many ways to the original... and a lot easier to use than is PC Paintbrush or Microsoft Windows Paint. This is a phenomenally enjoyable program equally suitable for a bit of image hacking or for serious art. It's a must for desktop publishing. Requires EGA or VGA card and a mouse.

DGTERM is an immensely clever program which pops up a telecommunications terminal from within any application and allows for background XMODEM and YMODEM file transfers.

FINANCIAL PARTNER is a storehouse of financial planning utilities. It will work out amortization tables for loans, help you plan annuities and so on. No one with more than twelve dollars should be without this package.

FR386 is the fastest, slickest and most stunning fractal graphics package we've ever seen. It includes a zoom box which lets you move successively closer to the images you create. Requires an 80386 based computer and EGA or VGA card.

HPCALC runs under Microsoft Windows and gives you the complete functions of Hewlett Packard style programmable scientific calculator. No number will get away from you once you have this thing running.

LOOKFOR is a powerful text search utility which will find selected strings of text in any number of files. It's a useful research tool... and a great asset for people who can't remember where they last saw something.

QUIKCOPY is a replacement for the DOS DISKCOPY program. It copies disks in about half the time, and allows for multiple copies of the same disk without reading the original for each one.

RACECAR stands proudly in the tradition of brilliant public domain ASCII games. Using nothing more than text and colours, it allows you to drive a speeding car through a twisting, debris strewn race course until you finally pile up on the walls or oil slicks.

TIFFANY is the first really workable screen capture utility for Windows we've encountered. It allows you to create graphics files from any window on the screen.

TRAN is a rather astounding piece of work. It reads text files... through the speaker of your PC, in English.

ZAPDIR kills whole subdirectories in a single shot. It ends the annoying requirement of DOS that you manually wipe out all the files and sub-subdirectories in a subdirectory before you remove it.

\$19.95

VOLUME 47

LETTERS 'N LABELS is a fabulous mailing list manager if you have moderate sized lists to keep. It will store them in a custom data base, let you update the list and print out labels whenever you need them.

ARGH is the sound that most people make after playing this puzzle game for a while. It's just a series of sliding blocks, but it'll drive you mad trying to solve it.

DERASE is the most comprehensive file un-eraser we've seen so far. It handles everything from floppies to hard drives of up to thirty two megabytes, and it tells you if your files have been trashed and are therefore unrecoverable.

HPPS is a PnTc replacement especially designed for owners of HP LaserJet Plus compatible laser printers. Includes ASM source.

LAST RESORT keeps you going when your computer hangs. It will get you back to DOS, copy the contents of a RAM disk onto something more permanent and restart your heart when your system appears to have locked up solid.

AXEL-F plays the theme from Beverly Hills Cop. It's not all that useful, to be sure, but it's small and fun. Requires BASIC.

LIFETIME is a serious program which uses solid statistical research to estimate your life span based on your health and lifestyle... it can be a bit sobering. Requires BASIC.

POPDATE is a really well executed pop up calendar which shows you the current, previous and next month for any month you like.

800K uses the high density drive of an AT or 386 based machine to format normal low cost dual density floppies to hold eight hundred kilobytes worth of data, or more than double their usual capacity. It's a great money saver, considering the price difference between these and quads. Includes ASM source.

FINDER is a Microsoft Windows utility which locates files anywhere on your hard drive.

DO-ONCE is a program which can be set up to run specific applications, utilities or batch files at specific times. It will, for example, automatically back your hard drive up to a streamer every Friday afternoon once everyone has gone home. This the most flexible and reliable one of these things we've found to date.

GLEANERS is a complete index to National Geographic magazine from 1957 through to 1987, along with a really superb database program to search for things by subject, place and so on. It's great for research, and essential if you've been saving back copies for a while.

\$19.95

VOLUME 48

DRIVEL is a brilliant addition to any office. It produces very meaningful sounding text which is actually pure drivel. Suitable for use in memoranda, reports, letters and year end stockholders portfolios.

CPRINT is the ultimate C source file printer. Generates first class hard copy listings complete with headers, footers, page numbers and so on. Also generates indexes or contents pages for any source file.

EGARULE pops a ruler up over any EGA text screen. You can position the ruler where you need it, and use it for the accurate positioning of text in different applications. Requires EGA or VGA screen.

INVENTORY is a home or office inventory program which maintains a running database of your possessions. It keeps track of what everything's worth, and provides estimates of replacement costs. Reduces potential "negotiations" if you have to make an insurance claim.

JDOS will pop a command line up from within most applications. However, it does a number of clever things to allow you to have all the DOS memory in your system available for applications run from within other applications.

MORTGAGE is a powerful mortgage program. Does a number of types of calculations, and prints hard copy reports. It's great for doing "what if" plans to find ways to slaughter your mortgage quicker.

PIZZA teaches you to make pizza at home with a variety of recipes. Avoid getting anchovies in your disk drives.

POSTGIF is the best way of generating black and white printouts from full colour GIF files. This program creates true halftones... not dithers... from GIF files and stores them as EPS (encapsulated PostScript) files. These can include previews for use with Ventura publisher, too... use GIF files as black and white art for desktop publishing. If you've tried our Colour ClipArt disks, you'll want this program. Requires a PostScript printer.

SLEUTH is a fascinating graphic ASCII game. A murder has been committed in an old house. You must wander the various rooms, check out the clues and unmask the villain before you get it. The game changes with every playing or you can use your own cast of characters.

SORTDEM illustrates the process for sorting a list of words using five of the most popular sorting algorithms. You can see how each one works, and why each one is preferable for some applications. C language source code included.

\$19.95

VOLUME 49

PHONES is a Windows application which keeps track of telephone numbers... it'll even dial 'em for you if you have a modem attached to your system. Requires Microsoft Windows.

BRAIN asks you a lot of peculiar questions and evaluates how much of your thought processes are left brain, how much are right brain and how much are mixed brain. Requires a brain.

LM is the absolutely best mailing list program and label maker ever written. If you run a small business or just send out a club news letter every so often, this program will change your perception of the universe. dBase compatible.

ONEKEY is a keyboard macro program. It stores up to fifty strings, each one callable with the key combination of your choice. Ends buckets of repetitious typing. This is especially handy for Ventura users who precode their text.

ALDO is a game in the tradition of Mario Brothers. A little fellow with a beard leaps over barrels, climbs ladders and goes for the gold. Requires an EGA or VGA card.

POPDBF is a pop up utility which allows you to browse through dBase, Clipper, Foxbase and compatible database files from within any application.

TIKLER is one of the nicest tickler programs we've encountered. It reminds you of up to three hundred events on the future, without knotted handkerchiefs, bits of string or things written on your arm.

CAITY is small and so brilliantly pointless that we had to include it. It's a resident program. Run it and it plays a different musical note for every key on your keyboard as you run other applications. It's a delight to listen to as you type DOS commands... a veritable symphony in WordStar. Your fellow employees will want to kill you inside of fifteen minutes.

CONNECT4 is the best and most ruthless computer implementation of this popular game.

PALETTE allows you to set the colour palette in Windows sensibly. If you don't know you need this program you don't know how badly you do. C language source code is included. Requires Microsoft Windows.

LIFE is a three dimensional version of the now classic program. Watch a colony of creatures lunch out on each other. Primary a programmer's toy, the C language source code is included.

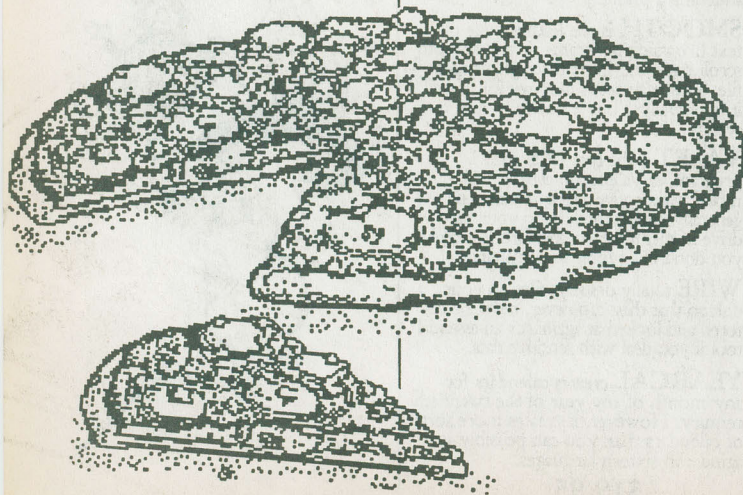
TRI-MAZE is a blast. It draws complex mazes and then challenges you to solve them.

PERIODIC is a brilliant bit of work. It displays the periodic table and lets you scan a cursor over it to get detailed information about each element. Requires an EGA or VGA card.

FANS is supposed to be an EGA demo for a graphics library, but it's so fast and good we've included it here. Pilot a space ship through a field of waving fans catching bouncing loonie dollars as you go. An EGA or VGA card is required.

CHESS is a three dimensional chess game which actually allows you to move the pieces around, rather than just typing in co-ordinates. This has to be the last word in computer chess. Requires an EGA or VGA card.

\$24.95 (2 Disk Set)



ALMOST FREE™ GAMES

VOLUME 1

CARD is a simple draw poker game. In addition to genuinely random play, you can shoot it if it cheats without having to worry about its brothers coming after you for vengeance.

CASTLE remains one of the most fun public domain computer games yet devised. Wander around a sort of deserted castle collecting things and trying to find the way out. More fun than sudden, blistering death.

CHESSII is a pretty sophisticated chess game with a graphic board. You can actually pick up and move your pieces, rather than having to enter board co-ordinates. ChessII features multiple look ahead levels, too. Requires CGA or EGA card.

EGAROIDs is a brilliantly executed Asteroids game for EGA and VGA cards. It's fast and deadly... if you get crunched by an asteroid, you suck vacuum. This version corrects the incompatibilities many users encountered with the one previously offered on our almost free software disks.

FROGGER is a PC version of the classic arcade game. Try to get your frog across the road without him winding up splattered by the traffic. Less messy than real life. Requires a CGA or EGA card.

HAUNT is a text based adventure game in which you attempt to work your way through a haunted house. It's quite a large house, though, with an endless plethora of rooms and objects

LINKFOUR is a computerized version of the popular Connect Four vertical checkers game. Try to get four coloured dots in a row before the computer does. It's a classic puzzle. Requires a CGA or EGA card.

PACKGAL is an ASCII based version of PacMan. It plays like the wind, though, and is every bit as exciting as the arcade version... except that it doesn't inhale quarters.

PINBALL2 simulates the action of a pinball machine on your computer. This one has all sorts of traditional pinball phenomena, including flippers, out lanes, kickers, gates and so on. Requires a CGA or EGA card.

TREK lets you tear through space meeting interesting new life forms and slaughtering them. It's a complex graphic space game with lots of action and even a plot of sorts. There's no blood like green blood. Requires a CGA or EGA card.

WILLY is the strange and wonderful saga of willy the worm. In this episode, you get to help Willy go home. Willy is a graphic arcade game clearly written by someone a little warped. Requires a CGA or EGA card.

\$19.95

VOLUME 2

BRICKS is a classic implementation of "Little Brick Out", a game which dates back to the earliest personal computer. Kill bricks and relive a bit of history.

FLEES is a lightning fast, arcade quality alien slaughter game... get the space fleas a'for they get you. Slaughter and green blood abound. Requires an EGA card.

PANGO is a rather strange little arcade game. You wander around kicking the hell out of bricks and squashing bees. It's fast and peculiar.

PIRATE is a huge graphic adventure game in which you wander through tunnels searching for buried treasure. The pictures are good, the plot is clever and gory, violent death awaits you. Fun for the whole family if they're a bit blood thirsty.

PITFALL pits you against the most dreaded space enemy of all... gravity. Pilot your ship down through the pit without getting mashed on the rocks. Works with any video card.

RIBIT2 is the best public domain implementation of frogger we've encountered for a PC. Get your frog across the highway without having it run over and turned into french cooking.

ROUND42 is a peculiar little effort along the lines of space invaders. However, it's fast and evil, and will take you a long time to get the better of it.

STRIKER puts you in command of an attack 'copter flying into enemy territory. It's all done with pretty slick graphics, from the chopper itself to the missiles which will blow you into the next game room. Just like an arcade but it doesn't need quarters.

SUBCHASE is a graphic war game. You sail along dropping depth charges on unsuspecting subs. They frown on this sort of thing now, but it was very trendy in the early forties.

\$19.95

VOLUME 3

CAPTAIN COMIC is the best video game ever written for the PC... commercial or otherwise. It's along the lines of Dark Castle on the Mac... you guide your little purple faced hero through a complex graphic world, picking up things and killing life forms. It's wild, fast, brilliantly conceived and enjoyable beyond words. Requires an EGA or VGA card and a thirst for adventure.

3-DEMON is three dimensional Pac Man. Wander through graphic corridors picking up food pellets and avoiding the ghosts. Requires a CGA card.

QIX is an ASCII version of the arcade game. It's fast and runs on even the simplest PC.

RACECAR is a brilliant ASCII game that lets you steer a car through a writhing, debris strewn course of death and disaster. It's an insurance agent's nightmare but a hell of a good play.

SEAHUNT is a computerized Battleship game. It involves strategy, skill and a grasp of military tactics. You also have to like sinking ships.

\$19.95



THE EXECUTIVES

If you own a PC, XT, or AT compatible microcomputer, you'll probably have heard about the power and economy of low cost public domain software and shareware. However, if you've ever tried to make sense of the thousands of cryptic programs available in the public domain, you might well have abandoned all hope of any of it ever being of much use to you.

We'd like to introduce you to our Executive Software Series... no fuss, no risk software. We'll make your computer dance... with no piper to pay. We sort through six to eight megabytes of public domain software to create one of these collections. We weed out the programs which don't work properly, the ones which just aren't suitable for business applications and the ones which contain computer viruses.

VOLUME 1

XWORD translates text files created by one word processor into files compatible with others. Supports WordStar, WordStar 2000, XYWRITE II Plus, WordPerfect, Multimate and SideKick.

BANKER will help you balance your checkbook... as much as anything short of divine intervention really can.

APPBK is a memory resident appointment book.

BROWSE lets you scroll back and forth through text files like a word processor without waiting for one to boot up.

CARDFILE is a memory resident address book you can pop up from within any application. Even dials your phone.

DCACHE is a "disk cache". Installed, it will speed up just about any program which uses your hard drive frequently.

DELZ The DOS DEL command doesn't completely destroy the contents of a file, and potentially sensitive files can be brought back without your knowing it. DELZ destroys all trace of a deleted file.

DIRNOTES allows you to affix notes and comments to any file on your hard drive.

DOSEDIT is a must. If you type a command incorrectly under normal DOS you'll have to retype it. With DOSEDIT installed, you can call back previous commands, edit them and use them again.

FREE tells you how much free space is available on any floppy or hard drive.

FREEZE locks up your PC while you're away, protecting your sensitive files from a quick disk copy.

KEY-FAKE lets you bypass the start up screens of most applications by "stuffing" the appropriate keystrokes into your PC just before the application boots.

LOCATE will find any file on a complicated hard drive.

LOCK and UNLOCK allow you to encrypt sensitive files so that only you can get at them. Works with text files, spreadsheets, data bases, etc.

NPAD is a small, memory resident note pad you can pop up from within any application to jot things down on.

POP-CAL is a calendar which can be popped up from within any application. Shows you a correct calendar page from any month of any year from 1582.

RENDIR allows you to rename subdirectories as you currently rename files.

VTREE is another of those essential little programs. It draws a map of the subdirectories of your hard drive.

RN shows you a map of the subdirectories of your hard drive and allows you to change directories by simply pointing to the area you wish to log into.

SETUP sends control codes to your printer. It allows you to change fonts and effects without having to remember scores of obtuse escape sequences.

SNIPPER copies the contents of any text screen into other applications. Extract part of a spreadsheet and pop it into a report being set up on your word processor.

SWEEP lets you execute any command you like in every sub directory of your hard drive.

TSR MANAGER is a collection of utilities which will keep your pop up utilities, resident programs and other TSR's from rising up to consume you. Also includes utilities which will help you identify TSR conflict problems.

CONFIG allows you to change the way your CONFIG.SYS behaves when your system boots up. Exclude specific drivers or commands to free up memory.

READRITE allows you to analyze how readable your writing is... as you write it. It pops up from within your favourite word processor and produces a readability index of the screen contents.

VOLUME 2

BCOPY is a replacement for the DOS COPY command which copies files as a background task. As soon as you let it go, it returns you to the DOS prompt so you can get back to what you were doing.

BELL makes the beep in your PC sound like an electronic phone.

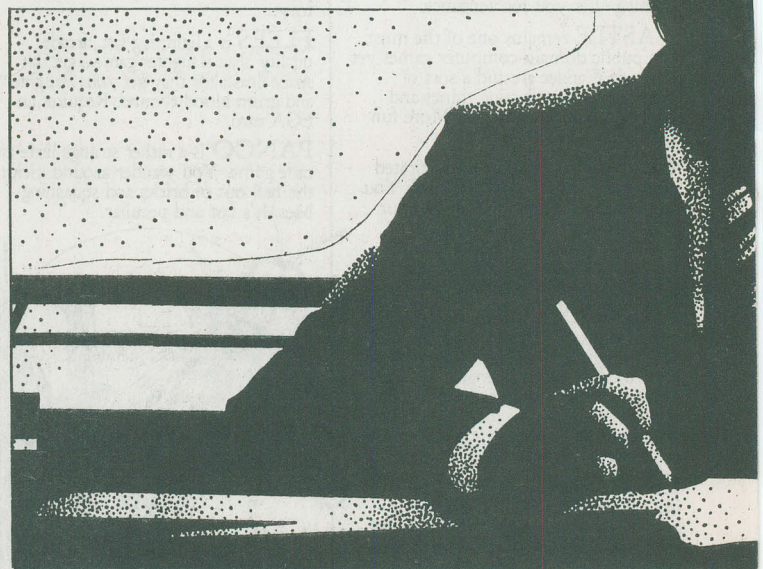
NJFRERAM will tell you how much free memory is left in your machine from minute to minute, even when you're inside an application.

CASE will convert text into all lower case, all upper case, capitalized words and it'll even clean up WordStar files.

MAXI is a disk formatting program which will allow you to get four hundred kilobytes on a regular 360K disk, or almost a megabyte and a half on a quad density disk.

POPCALC is a handy four banger calculator which pops up in a window whenever you need it.

MCOPY is a DOS COPY replacement with lots of features. Copies files over multiple floppies if you have too many to copy onto one. It uses a sophisticated algorithm to ensure you use your floppy space efficiently. It's a replacement for BACKUP and RESTORE in this case. Also does CRC checks to make sure your important data isn't corrupted.



WHEREIS locates files on your hard drive... no matter where they're lurking.

TONTO is a sort of SideKick done which provides a number of useful functions in a window when you call it forth.

VFILER is a file manager which will help you move, copy, rename and delete lots of files without lots of typing.

ADDRESS is a resident envelope addresser which works with most popular word processors. It allows you to roll an envelope into your printer, hit a key and have the envelope addressed automatically. Will also print a specially designed graphic return address if you like.

VCHECK protects your system against computer viruses. It checks sensitive files in your computer to make sure they haven't been infested.

SETALARM is a simple memory resident reminder that will beep at you at a pre-arranged time.

SILENCE kills the speaker in your PC when you don't want to be beeped.

VTREE2 is an enhanced version of the VTREE program on our first disk. It maps out the tree structure of your hard drive and tells you how much space each directory occupies.

WORLDTIME will tell you the correct time in any city in the world.

VOLUME 3

CLEARCUT will make your writing more readable by helping you to spot excessively large or difficult words.

CALLFOR is the pop up equivalent of pink message slips that litter most offices.

SHFTPICK allows you to skip over the loading of resident programs when your computer boots up.

SMOOTH is a text "browsing" program. Lets you read documents by scrolling. EGA or VGA card required.

VALET is a DOS shell allowing you to use simple menus rather than complex typed commands to handle moving files, changing directories and so on.

WIPE will obliterate every trace of a file. Essential for sensitive data.

YEARCAL prints up a calendar for any month of any year in the twentieth century... in sixteen languages.

ASEASY is a powerful spreadsheet package, in many ways the equal of Lotus. Small, fast and not copy protected.

BANNER prints up any phrase you like as a huge banner lengthwise along a strip of printer paper.

CALENDAR is a desk calendar and daily planner with lots of options. Much harder to misplace than the paper kind.

PALERT warns you when you're running out of disk space, saving you from a computer full of work and no way to save it.

BOTH lets you print long text files on both sides of the paper.

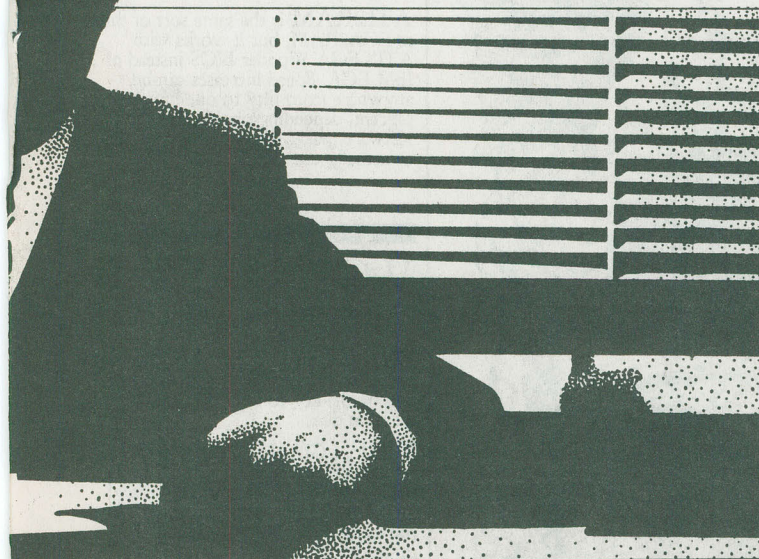
LOCKERUP lets you lock your keyboard instantly when you're not there, protecting it from unauthorized access.

SOFTWARE SERIES

We're very, very good at spotting the latter. The result of our efforts is available on a disk for just \$19.95. Each volume of our Executive Software Series contains an assortment of utilities and applications which will make your computer work harder for you. Executive Software Series disks provide you with programs that are up to date, virus free, business oriented, well de-bugged and well

supported, and a complete volume...typically a one or two dozen separate business programs...costs less than a good lunch.

Finally, every Executive Software Series collection carries our promise of satisfaction. If you don't think it's fair value, we'll buy it back from you for every cent you paid for it.



COVER prints the directory of a floppy disk so that it slips into the disk sleeve as a reminder of what's on the disk.

DISKLITE is for people with machines that have internal hard drives and hard-cards. A flag in the corner of the screen tells you when the drive is running

VOLUME 4

CALCQF Speed up your computer... possibly by several hundred percent... with no tricky hardware changes. Calculates how much of a speed increase you can realize and then sets up your machine to do it.

CONFMT allows you to format disks in the background while you're performing another task.

FM is a menu driven file manager. Copy, move, delete and generally meddle with your disk files, without typing commands.

FORMATQM formats lots of floppies very, very quickly, and is a worthwhile companion to **CONFMT**, above.

FINANCIAL PARTNER provides you with a variety of handy financial planning tools all in one program. Work out loans, annuities and other common money matters with blinding ease.

HERCSAVE, for anyone using a Hercules compatible graphics card, blanks your screen after a set period of inactivity to avoid burning out your screen.

INSTACALC is a spreadsheet in a can. It's memory resident, and you can pop up a full blown spreadsheet program, complete with macros and all the trimmings, from within any application.

JETLAG helps you calculate how long you should be prepared to take it easy after a long international airplane journey.

MEMO will print memos with the word "MEMO" at the top in huge special effect characters. Requires a PostScript printer.

MURPHY helps keep your sanity by printing, from the **AUTO EXEC** file, a different clever thought every morning.

PINPRESS prints up to sixteen kilobytes of text on a page. Great for making archive copies of large documents. Requires an Epson FX-80 compatible printer.

POPDOS2 is a pop up utility which will handle your files and directories effortlessly from within any application.

QUICKCOPY is a replacement for the **DOS DISKCOPY** command. It duplicates disks in half the time or less, and makes multiple copies even quicker.

TED is the world's smallest text editor. Use it for creating batch files, quick notes to yourself and other instant files.

ZAPDIR kills off subdirectories with one command... even if there's still something in 'em. Saves on manual deleting.

UNWS is a quick 'n nasty filter to turn WordStar files into text.

VOLUME 5

DERASE is the best file un-erase program we've encountered. It works on all formats of floppies and hard drives up to thirty two kilobytes, and recovers most accidentally deleted files.

LETTERS 'N LABELS is a mailing list manager for moderate size mailing lists. Manages your lists, let you update and edit them and print out labels. It costs less than the courier to a mailing house.

LASTRESORT gets you back to **DOS**, and usually allows you to save your files, when your computer hangs. It can save you hours of work that might otherwise have been lost to bugs or static shocks.

800K allows you to format normal dual density 360K floppies to hold eight hundred kilobytes in the high density drive of an AT compatible computer.

WMF manages a portfolio of mutual funds... diligently. Allows you to edit and update your portfolio, print reports and even see detailed graphs.

MONEY WATCH is an elegantly simple money management program which is equally useful at home, for small businesses and for handling the finances of individual departments of larger businesses.

VOLUME 6

INSTANT NETWORK Using nothing more than a simple serial cable, this package will network any two PCs together. You'll be able to share files, share peripherals and basically have all the advantages of a small local area network.

LASER FONT EDITOR is a LaserJet laser printer soft font editor. It's mouse and menu driven, and includes special effects such as drop shadows and outlines. Requires a Microsoft compatible mouse.

BS We won't tell you what "BS" stands for in this case, because we're sure you can work it out for yourself. Creates very meaningful sounding but very meaningless text. The ultimate inter-office communicator.

FILE FINDER Faster and more flexible than Norton's **FF** utility, this program will find any file or group of files on your hard drive. Has many options to help you fine tune its search capabilities.

EGA RULER is for anyone who uses an EGA or VGA card. It will pop a text ruler over your work to help you line up spreadsheet columns, adjust your letters to fit your letterhead and so on.

WINDOWS FINDER is a Microsoft Windows application which will locate files anywhere on your hard drive, a Windows equivalent to our **DOS** file finder above.

INVENTORY should be on every computer on the planet. It helps you keep track of the contents of your home or office, providing you with a running count of the replacement cost of your assets.

INTEREST CALCULATOR is a great little loan calculator. Given the principal, interest rate and payment size of a loan, it will print up a table to tell you how long your indenture is going to last. You can also give it a fixed term and have it calculate the payments, and so forth.

JDOS is a tricky little program which allows you to pop a **DOS** command line up from within most any application... even if your application doesn't have a **DOS SHELL** facility. Will give you a full house of memory to run programs in, not just what's left over by your first program.

NOTE is a browse program which runs as a pop up utility. Allows you to read any text file from within another application and it only ties up a few kilobytes when it's hiding in the background.

VOLUME 7

DECEIVE is designed to save your job in the event that someone in authority pops in unexpectedly. Allows you to copy any screen from a business-like application and instantly pop it up over your video game, resume or other incriminating effort.

INVOICER is a complete inventory management, accounts receivable and invoice generator package. Will manage most small to medium sized inventory and invoicing applications with power to spare.

LM is the hottest label maker and mailing list management package we've encountered. Whether you use mailing to generate sales leads or just mail out club newsletters, having the mailing list in house makes your responses more cost effective.

KDCG is a really elegant calculator program. It runs from the **DOS** prompt and provides a calculator that's as close to a real one as you can get. Requires an EGA or VGA card.

PHONES maintains a list of telephone numbers for you. If you have a modem, it can even dial them for you. Requires Microsoft Windows.

POPDBF is ideal for anyone who uses dBase, Clipper, Foxbase or any dBase compatible packages. It's a pop up window which allows you to browse through any **DBF** file from within any application.

MINDREADER is a word processor for people who can't type. As you type, it uses artificial intelligence to guess what you'll type next. If it guesses correctly, you can have it insert the next word or words for you. If not, just keep on typing.

ONEKEY is an elegantly simple keyboard macro program which takes up almost no memory, is easy to program and holds up to fifty macros. Better than ProKey for a fraction of the cost.

LEISURE LIBRARY

VOLUME 1
COLOUR CARD
PROGRAMS

AQUARIUM make your monitor a fish tank which cannot spill onto your computer. Good for endless hours of meditation. CGA is required.

MSLIFE or more fully, the game of life for Microsoft Windows. A mouse is almost vital for setting up screens. This version has some nice features, including constant update of the MSLIFE icon.

AIRPLANE allows one to display and print blueprints for paper airplanes. Great for office mayhem. CGA and BASICA or GWBASIC are required.

SIMCGA version 4.0, the latest we've found. As with earlier SIMCGA's, this is simple to use. It supports all three CGA modes, normal, forty column, and hi-res mono mode. All the CGA programs on this disk worked for us with SIMCGA.

HELPME cannot be described. If it does not startle, perhaps even scare people around you, find some people to show it to. Run it and listen to what happens!

SAYTIME basically just says the time. This is a resident program which will cause your system to speak the current time whenever the correct key code is entered, even when you are in another application. Great if you can't see a clock and your screen is too full for an on screen one.

CALLTIME should only be used by Torontonians. It calls Toronto's own radium clock, and grabs the time correct to the second, then installs it on your system. If you have an AT, it even installs it in the battery supported CMOS. Requires a modem connected to an outside line which can call central Toronto without long distance fees. Version 3.1.

PLANETS computes information relating to the position, distance, magnitude, and so on for the major planets in our solar system on a specific date and time. A must for space travellers. CGA required for graphic displays.

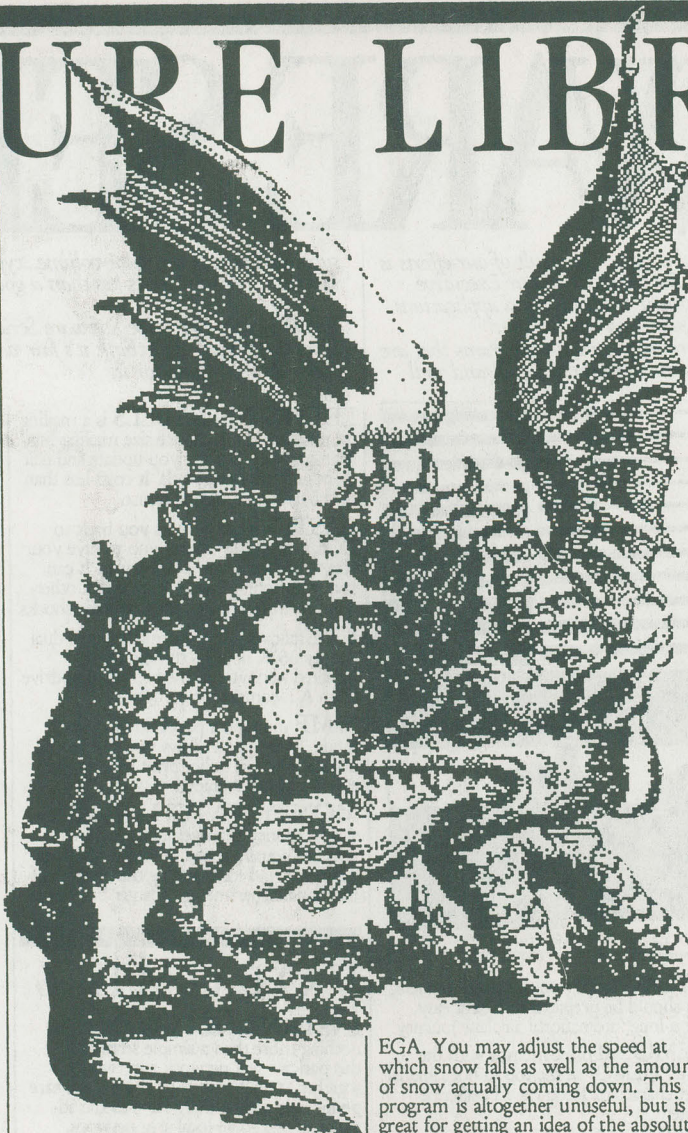
MELT clears your screen slowly. Sort of. This is the type of program which makes DOS's CLS command so ghastly boring. CGA is required.

DAZE This too, is a little weird. An excellent way to leave an unused computer, this colour demonstration leaves accounts receivables in the dust! CGA required.

WHIZ cleans the inner surface of your monitor with electron brushes already available to users who have CGA compatible systems. Great for that one glaring hard to get at place.

JOYCAL is a slick joystick calibration system specially designed for those with...you guessed it...joysticks. It will support both joysticks simultaneously, calculate the centre, then tell you how to adjust your stick.

DRSLEEP, Dr. Sleptite and the Nightmare Factory is a strange ex-



perience. Get fifty thousand volts through your body, be attacked by killer pillows, and above all, avoid sleep. The mad doctor is at it again. This game requires CGA.

\$19.95

VOLUME 2
EGA PROGRAMS

MONALISA is the lady herself. The picture is drawn slowly but accurately. EGA required.

EGAD is one of the most impressive EGA demonstrations around. It has everything from flickering photos to QIX lines to a multi-shape kaleidoscope in full colour. Supports mice and exploding boxes.

EGAWAL creates complex geometric patterns on EGA the screen. Run this and stand back and watch! Another great one for bored machines.

ROSES creates similar EGA patterns to EGAWAL, however, it creates them faster and makes them look more like flowers. The originality of program names is astounding, no?

EGASNO simulates a snowfall in

will keep in EGA. Select 15, 25, 35, 43, 50, or 60. Also included is a command to give you 120 columns. Works only with EGA.

EGA2RAM takes IBM EGA BIOS and stores it in RAM, then tells the computer to refer to the RAM copy of the BIOS instead of the ROM. This speeds up many EGA screen writes, since RAM is much faster than ROM. Assembler source is included.

ATI2RAM is the same sort of thing as EGA2RAM, but it works with ATT's EGA Wonder BIOS instead of IBM EGA. Speed increases can be anywhere from fifty to one hundred percent, depending on whether the software makes direct memory writes or actually uses BIOS.

\$19.95

VOLUME 3
GRAFICS & GAMES

EGA2GIF is a memory resident utility which grabs EGA screens when you hit the key combination, and stores them on disk.

VGIF, a GIF picture viewer in EGA, can also convert GIF pictures to formats used by various paint programs, including EGAPaint, PC Paintbrush, etc. Also allows for slide shows of pictures. Included are three GIF pictures to start your own slide show.

XONIX is a fast paced game of luck and mental coordination. This is perhaps one of the most addictive games around. CGA required.

ALDO is a game which was created specifically for AT286 machines with 256K EGA cards inside 'em. It's basically a Donkey Kong clone, with really smooth graphics.

DALEKS will be a natural to all Dr. Who fans. The object of the game is simple...smash as many of the robots as you possibly can before getting killed.

PITFALL is a simple but fun exercise in futility. You are dodging the walls of a pit as you fall deeper and deeper. Trouble is, the pit gets narrower as you go.

MUMMIES is a simple low resolution game which is actually quite similar to DALEKS. While exploring the tomb of the ancient King Mut, you are set upon by hordes of mummies. Wonderful topic for a computer game, and it's fun.

SCRABBLE is Scrabble. This one is in EGA, knows all the rules, and even keeps score for you. Definitely a classic computer game, even if it can't play against you.

CHESS is a very small chess player, rather fast, not impossible to beat. CGA is used, and the pieces are made of not wood or metal, but realistic graphics. Small enough to fit in a pocket, it's just the thing to while the time away when you should be word processing.

\$19.95

COLOUR CLIPART



If you have an EGA or VGA card in your system, you only think you've seen computer graphics until you've seen these pictures. Even if you're stuck with a lowly Herc board, these files are pretty exciting.

The GIF format allows for all the resolution your computer can handle... some of these pictures have two hundred and fifty six colours and sufficient detail to make them all but indistinguishable from photographs. The result... seen in the crisp, luminous colours of a computer monitor... is wholly stunning. We've included viewer programs for these files to really do them justice.

Once you get finished viewing them, you can actually use 'em for something, too. We've included a utility which will dither them down into black and white PC Paintbrush PCX files suitable for use with virtually all the desktop publishing packages on the planet, including Ventura, PageMaker and WordPerfect. This is a considerable improvement over the PCX con-



verter which comes with Volume 1 of our GIF collections... if you ran up against the limitations of that software, the newer one will be a great improvement. Technology marches on. A growing number of production houses will generate colour separations directly from data files such as these, by the way, so you can use them to go directly to four colour printing if your application calls for it.

Because of the size of these files, we're distributing them on a single quad density disk for just \$19.95. You will need a 1.2 megabyte AT drive to read it. If you can't get this together, you can order these collections on several dual density floppies for \$31.95. (Sorry about the up charge... it's for the duplication time.) The colour images above are fragments of some of the files in this collection... although they lose a great deal in the printing process.

VOLUME 1

DRAGNLDY This is the most amazing computer graphic you'll probably ever see, as well as being a fabulous piece of art. It's a lady and her pet... and her tatoo. (Note that this file is too large to fit on a single 360K floppy. If you buy the 360K disk set, we'll include a 50% scaled version of it.)

VARGA One of the original paintings by Varga, a lady and a phone.

BABOON A colourful mandril.

BLADERUN From the film.

BODE1 A seductive little wench from the pen of the late Vaughn Bode.

DESTRO Star Wars. star destroyer.

DOLPHN A painting of two dolphins.

DRGN A pretty evil looking dragon.

FRUIT A still life in phosphor.

UANGEL An angel and a unicorn.

KINGTUT The death mask of the boy king, the face that launched a million T shirts and coffee mugs.

LIGHTS Night time.

MOUSE Amazing resolution.

OPTIC1 An optical illusion.

PEPPER A digitized album cover.

SHORTS A girl in cut off Levi's.

Honest... they made me do it.

STEPH A girl in a T shirt.

TALLSHIP A clipper ship.

TURNER1 A painting by Turner.

TURNER2 Another painting by Turner. Both of these are pretty nearly photographs.

MONKEY A photographic quality reproduction of a Rhesus monkey.

VOLUME 2

APRIL A calendar girl

AZTEC A mural

BEATLES You remember!

BRONZE A sculpture

CEZANNE A self portrait

CIRCUIT A circuit board

EARTH A well known planet

LIPS Ahh... lips

NEST A bird in flight

P2NUD2 A woman.

PARROT A bird not in flight

SAX The instrument

SURFER Man, board, tube

THISTLE A seed pod

WHALES ...and ruins.

FRAISE French strawberries?

GLASS from the twilight zone

BEE An insect

DOGS1 Actually, only one.

CATS10 2 cats, 1 hat, no ham

GORILLA A famous image.

TETCHA A dusky maiden

VOLUME 3

ANGELA A girl named Angela.

APR89 Woman and machete

TECH Chrome plated woman

BALLOON A hot air balloon

BOUQUET Flowers

COMDISK A compact disk

DRHOUS A dream house

EYE Close up of an eye.

FISH Just before the cat got'em

JILL Jack's sister.

LEGEND A fantasy scene

MICKEY Fifty year old mouse

PANDA — Art deco bear

SANCT Ocean and no dead birds yet.

TAROT Two cards

TENSPEED A bicycle

WAVES The ocean revisited

GODDESS Home perm aftermath.

LOVERS Two people and a fireplace

S O F T W A R E F O R T H E P C

CLIPART

FOR PC/XT/AT AND MACINTOSH

Digital ClipArt is the spice of desktop publishing. However, unless you have a scanner and a ready source of hard copy clipart at your disposal, you'll have a hard time amassing a library of images. At least, it used to be.

Almost Free Ventura ClipArt picture collections are disks full of image files. Each disk has a variety of pictures, both for spot illustrations and full pages. They're suitable for reproduction on any output

device. Almost free clip art now supports Ventura Publisher, Aldus PageMaker and WordPerfect 5. In fact, it is compatible with almost all desktop publishing packages, paint programs and word processors which accept graphic files. Each disk comes with a utility to convert the clipart to MacPaint, GEM/IMG, PC Paintbrush PCX and PCC, and TIFF file formats, suitable for use with a wide variety of applications. Only \$19.95 each.

VOLUME 1

BABY, BELVEDERE,
BLUES BROTHERS, BLUENUN,
BUGS, CHEETAH, CLIPART,
FISHES, GIRLWING, KNOT,
KOALA, LETTER A,
HEARTS, WOMAN,
RELATIVITY, SCAN
ESCHER WATERFALL

VOLUME 2

AIRCRAFT, BUTTERFLY,
CAR LOGOS, MORE CLIP ART,
COLLECTORS CARS, CUBE,
DANCERS, DRAGON, GLASSES,
GREYHOUND, HANDS,
MORE KNOTS, SKELETON,
LEATHER GODDESS,
MINOTAUR, TIGER,
ANOTHER WORLD, ZEBRA GIRL

VOLUME 3

BADNEWS, DRAGONS,
DREAM, KIDS1,
MEN1, WOMEN1,
MONALISA, CAT,
RHINO, TRIANGLE,
OLDMAN, SHELL,
BEACH, FLOWER,
PAISLEY

VOLUME 4

BUDBRAIN, DRAGON2,
SKULLS, KIDS2,
MEN2, WOMEN2,
PERSUIT, SUNDIAL,
PORCHE, EASTWOOD,
VANGOGH, IBM WARS,
STELLA, QUADRANT,
YAWN

VOLUME 5

BIRD, BOOP, BORDER,
CLIPART1, CLIPART2,
CONAN6, COUPLES4,
DRAGONX, ELEGANT,
HUNTED, KIDS3,
KRAZYCAT, MEN3,
SCRAPS, SCROOGE,
SPLINTR, WOMEN3

VOLUME 6

AUSTRAL, CLIPART3,
CLIPART4, CONAN1,
CORNCOCK, DONATELL,
IBMGIRL, KIDS4,
MEN4, NEWMACS,
PANEL, PINUP,
POOH, SPORTS,
WOMEN4

VOLUME 7

ANBORD2, BIGBEN,
BORDER4, CIVWAR,
DRUIDESS, FISH,
GARDENWA, GIRL12,
INSECTS, LIONCUB,
MINTPLAN, NATURE,
PIE, RUINS, WEAVING,
WMAF, MISC1

VOLUME 8

ANTBORD, BERRIES,
BORDER1, CUTOUT2,
DOG, EAGLEBOR,
FLWALL, HORSE, INDIAN,
JACKIESC, JAGUAR,
KNIGHT, MACRAT,
OWL1, PITCHER, PIZZA,
STUFF2, HKGIRL

VOLUME 9

BAND1, BUGSBNY2, CAROL2,
CLIPITS1, DRAGPRIN,
FEMHEAD1, FEMHEAD2,
FLEURLS, HANDS3, JAPANESE,
LOVELIPS, SAILMAN,
MENHEAD1, MENHEAD2,
PEACOCK, SKULLROS, SPACE2,
TILES, WEREWOLF

VOLUME 10

BAND4, BUGSBNY, CLIPITS2,
DAFFYDCK, DISCUS,
DRAGNLDY, EARTH,
FEMHEAD3, FEMHEAD4,
ELMRFUDD, GEOMETRC,
HANDS6, HANDS7, MANHAT,
MENHEAD3, MENHEAD4,
NOUVEAU, TWERPISA, SPACE1,
TIGER, WALLBORD



LASERART

PROFESSIONAL DESKTOP PUBLISHING
CLIP ART FOR THE PC



If you use desktop publishing, you'll know that having some electronic clip art around is a quick way to liven up otherwise dull text. Unfortunately, due to the considerable size of really high resolution clip art, most of the images that are available in clip art libraries are fairly small. Getting a full page graphic together is very difficult.

Our first collection of Almost Free Laser Clip Art addresses this problem with over a megabyte of high resolution, black and white three hundred dot per inch images. They're kind of huge, but they're also extremely attractive when you integrate them into documents. We've tried to create a collection with something for every application.

These files are provided for the PC in the GEM/IMG file format, suitable for pouring directly into Ventura Publisher documents. However, we've also included our flexible ICON image conversion program with the collection to allow you to convert them into PC Paintbrush and TIFF files for other applications. They're suitable for use with virtually all professional PC based desktop publishing systems.

This collection is available for \$19.95 on a single quad, 1.2 megabyte floppy (AT or 386 system required) or for \$31.95 on multiple dual density floppies.

VOLUME 1

CHUCK a woodchuck
JUNGFRAU a Victorian etching of a girl's face
ANCHOR and a mermaid
BEACH fun at the beach
LADYMOON a fairly famous etching of a woman sitting in a crescent moon.
NEPTUNE the ocean god, fork and all
MOORING a still life of a lake
PIRATE argh, Billy...ye' ever been t' sea?
MOUSETRP very elaborate mousetrap

CHEF a chef with a fondue pot
WABBIT a rodent on the run
FATCAT an obese feline
ROBIN real robins dream of being this detailed
SKYOCEAN a world map
DOG a really cute little dog... wait'll it grows up
STAGECH a cartoon stage coach
REVELE a bugler
OLDLION a bespectacled king of beasts
SCARECRW former resident of Oz
CASTLE a fanciful medieval cottage

LASERJET FONTS VOLUME 1

If you use Ventura Publisher or any application which drives a Hewlett Packard LaserJet Plus compatible printer, you will certainly have experienced the lack of interesting fonts available with most commercial programs. Desktop publishing is really a bore if you can't drag yourself out of the usual mire of Times and Helvetica and sing once in a while. Now you can. Almost Free LaserJet soft fonts are collections of decorative headline faces to dress up your documents. They can be used with any application which talks to a LaserJet compatible printer. However, because of the popularity of the Ventura Publisher package, we've included a width table generator for each collection which will painlessly integrate these fonts into Ventura for you.

Abbode
Amityville
Avantis Basque
Begotten
Big City

Cartoon
Centurion

Channel Channel
Copper

Courier
GalaxyGlue

Garnet **Gillie**

Hoboken

Olivia Optimial

Olde Englishe

Ornation

Palatinus

Prestigus

Rocky

Script

Sebastian

These fonts are shown actual size and are 18 points in most cases with the exception of "Cartoon", which is 56 point.

\$19.95

EXECUTIVE SOFTWARE DISK OF THE MONTH CLUB

New Executive Software Series disks will be appearing roughly once a month. If your day is too full to allow you the time to order these disks, we offer you our disk of the month club service. Join the club, provide us with a credit card number and we'll automatically ship you each new disk, billing your account. If you don't want to keep a disk, simply return it and we'll credit your card account. This service places you under no obligation... you can cancel it whenever you no longer need it. All club members will receive disks at the rate of \$19.95, or \$29.95 for two disk sets, for twelve calendar months, regardless of any price increases which may occur within this period.

To get on line with the Executive Software Series disk club, contact us by letter, phone, or FAX, or simply use the coupon below.

EXECUTIVE SOFTWARE DISK OF THE MONTH CLUB

Yes, I want to be part of the Moorhead Publications, EXECUTIVE SOFTWARE DISK OF THE MONTH CLUB. By completing this order form, I authorize Moorhead Publications to charge my credit card for each new disk as published.

I understand that there will be approximately one disk per month and that I will be charged the advertised price. I also understand that the maximum charge for any disk will be \$30.00 (Moorhead Publications is not planning any price increases. This takes account of double-disk volumes).

Charge my Credit Card
☐ Visa ☐ MasterCard ☐ AmEx

Account# _____

Expiry Date _____

Name _____

Address _____

Prov. _____ Postal Code _____

Signature _____

Send to:

MOORHEAD PUBLICATIONS

1300 Don Mills Road,

North York, Ontario M3B 3M8

(416)445-5600

FAX: 416-445-8149

DISK OF THE MONTH CLUB

By joining the ALMOST FREE SOFTWARE DISK OF THE MONTH CLUB you will not only save on long distance calls and postage but time as well simply because we can arrange for you to receive each new PC disk automatically. Here's how it works:

- You give us the authorization on the form below to charge to your credit card each new Almost Free PC Software Disk the day we put it in the mail to you. There will be approximately one new disk each month.
- You may cancel this arrangement at any time by calling our Software manager, Rick Cree. You may also return any disk that does not meet with your expectations for immediate refund.

Yes, it's that simple. If you would like to receive this service, please fill out the form below and mail to Moorshead Publications. The service will begin with the next disk.

ALMOST FREE SOFTWARE DISK OF THE MONTH CLUB

Yes, I want to be a part of the Moorshead Publications, ALMOST FREE PC SOFTWARE DISK OF THE MONTH CLUB. By completing this order form, I authorize Moorshead Publications to charge my credit card for each new disk as published.

I understand that there will be approximately one disk per month and that I will be charged the advertised price. I also understand that the maximum charge for any disk will be \$30.00 (Moorshead Publications is not planning any price increases. This takes account of double-disk volumes).

Visa _____ MasterCard _____ AmEx _____

Account# _____

Expiry Date _____

Signature _____

Name _____

Address _____

Prov. _____ Postal Code _____

Send to:

MOORSHEAD PUBLICATIONS
1300 Don Mills Road, North York,
Ontario M3B 3M8
(416) 445-5600
FAX: 416-445-8149

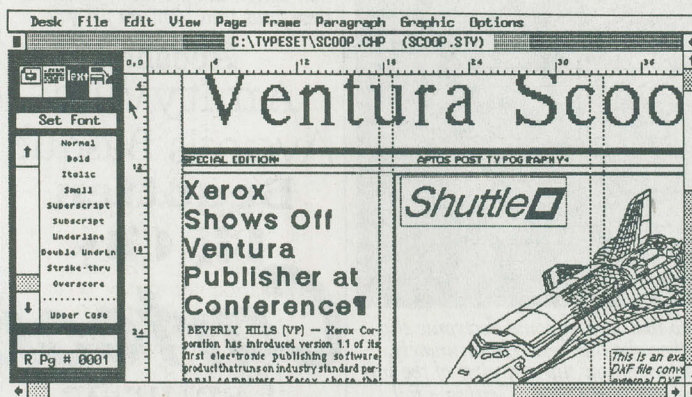
VENTURA SURVIVAL DISK VOLUME ONE

If you use the popular Ventura desktop publishing package, you'll probably be aware of a few of its... ahem... deficiencies. For example, you may have encountered the monumental difficulties involved in using it with additional soft fonts. Perhaps you've tried to pour image files into documents and found them a bit awkward. What about the unspeakable boredom of having to use the same type faces over and over again... it's driven lesser mortals back to their typewriters.

As long-time Ventura users ourselves, we've developed and collected quite an assortment of Ventura support programs. These things perform all sorts of useful functions, mostly with making Ventura a better place to live. Much of the software in this collection is specifically intended to make Ventura co-exist peacefully with a LaserJet compatible printer.

This is the first time we've offered all these handy programs in one comprehensive collection... and the first time some of them have been seen at all. These are the latest versions of all of these utilities.

If you publish with Ventura, you can't afford to be without this collection of programs.



FONTILT is a splendid program for making boring fonts into exciting ones. It inhales any standard LaserJet soft font and outputs a font with your choice of special effects added to it, including drop shadows, bounding boxes and even dripping blood.

VFM manages your Ventura soft fonts. It quickly makes width tables without any batch files to contend with, allowing you to add fonts to Ventura painlessly. This is a must for any Ventura user.

GEMSCOOP lets you view and optionally print out any GEM/IMG image file... without having to load Ventura. Supports CGA, Herc and EGA/ VGA monitors as well as LaserJet, PostScript and FX-80 printers.

PCXSCOOP is a version of GEMSCOOP for PC Paintbrush images.

MACSCOOP is a version of GEMSCOOP for MacPaint images.

HP-SLASH will reduce the often times voluminous sizes of soft font files by allowing you to selectively "prune" out unused characters and symbols. Saves on hard drive space and really speeds up font downloading.

MAC2PCX converts popular MacPaint files into PC Paintbrush PCX files, giving you access to a whole

plethora of instant clip art. If you have PC Paintbrush, this will make it easy for you to edit and modify MacPaint image files.

MAC2IMG converts MacPaint files directly into the GEM/IMG paint form used by Ventura. Saves on conversion time, disk overhead and gets around one of Ventura's long standing bugs.

TCAP is a memory resident program which captures text screens as GEM/IMG graphics suitable for pouring into Ventura documents as pictures. These screens preserve the original screen attributes and can be scaled to any size from within Ventura.

GCAP captures monochrome graphics screens into GEM/IMG files, suitable for pouring into Ventura chapters. A Windows compatible version is also included.

FSEE is a quick 'n nasty program to let you view the contents of a soft font file on your screen before you print it. It lets you see what new fonts will look like without your having to download them and print them out.

VPSCREEN is a Ventura screen font editor. It allows you to change the way fonts look on your screen.

\$19.95

BUSINESS

MA.BAS The Micro Accountant is a complete, working accounting and check register program, with a 25K documentation file. Requires BASIC.

PCWINDW22 A "Sidekick"-like co-resident window utility. Pop-up window functions include ASCII table, alarm, printer setup utility and notepad.

PSHIFT A time saving 'memory partition' utility. Lets you define up to nine memory areas. Load programs such as dBase II and WordStar into separate partitions and 'flip' between them with simple keystrokes.

PC-TOUCH.BAS Increase typing speed and accuracy with this easy-to-use typing tutor. Requires GWBASIC.

PCYEARBK is a useful appointments and reminder program.

TASKPLAN.BAS Project management software which lets you track up to 50 tasks during 50 time periods. Requires GWBASIC.

NOCOLOR A handy little utility for users with monochrome monitors and colour software.

MAXIT A simple but subtle game for two human opponents, or one player and the computer. Hours of fun!

PERTCHT A sophisticated project management tool using the Program Evaluation Review Technique.

PLUS More utilities to help organize maintain and copy your files, including a "monitor saving" program which blanks your screen when not in use.

\$19.95

HD SURVIVAL KIT

If you have a hard drive you can have all sorts of powerful utilities and programs installed in your system to make use of it more efficiently. We've collected the best of these utilities on a single disk to help new PC users get the most from their hard drive systems. Please note that these programs are included in our other almost free software disks. Descriptions of them are provided elsewhere in this catalog.

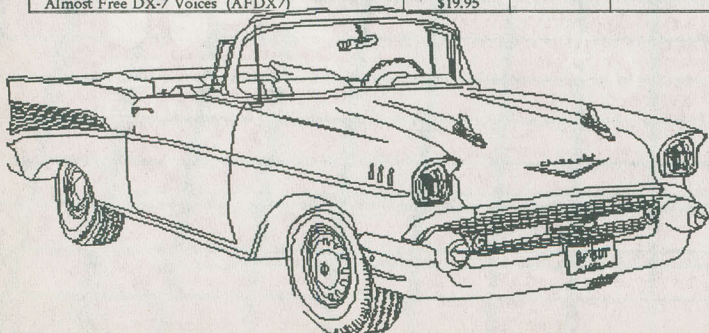
HGC	Colour card emulator for Hercules
ADDRESS	Resident envelope addresser
WHEREIS	Hard drive file finder
SIZE	File size finder
SETUP	Resident Epson printer setup
RENDIR	Sub-directory renamer
POPALC	Resident perpetual calendar
CLOCK	Screen clock
EDWIN	WordStar like editor
NANSI	Screen driver
CACHE	Disk cache
RAMDISK	RAM disk program
LPTX	Printer redirection
MURPHY	Foolishness and wisdom
LOCKERUP	Security system
BOTH	Printer paper saver
PCWINDOW	Resident grab bag
PINPRESS	Prints things very small
NOTEPAD	Resident notepad
FREE	Free space finder
HOTDOS	Multiple tasker
BLANK	Screen blanker
K9	Another resident grab bag
LAZY	Menu generator
UNWS	WordStar converter
MORTGAGE	Measure of your indurment
LOOK	File viewer
PCBW	Colour killer
VTREE	Hard disk map
VFILE	File manager
POPALC	Resident calculator
DOSEDIT	Command line editor

\$19.95

SOFTWARE CATALOGUE ORDER FORM

SOFTWARE

PC/MS-DOS	PRICE	QTY	AMOUNT
Almost Free PC Volume 1 (AFSPC1)	\$19.95		
Almost Free PC Volume 2 (AFSPC2)	\$19.95		
Almost Free PC Volume 3 (AFSPC3)	\$19.95		
Almost Free PC Volume 4 (AFSPC4)	\$19.95		
Almost Free PC Volume 5 (AFSPC5)	\$19.95		
Almost Free PC Volume 6 (AFSPC6)	\$24.95		
Almost Free PC Volume 7 (AFSPC7)	\$19.95		
Almost Free PC Volume 8 (AFSPC8)	\$24.95		
Almost Free PC Volume 9 (AFSPC9)	\$19.95		
Almost Free PC Volume 10 (AFSPC10)	\$19.95		
Almost Free PC Volume 11 (AFSPC11)	\$19.95		
Almost Free PC Volume 12 (AFSPC12)	\$19.95		
Almost Free PC Volume 13 (AFSPC13)	\$19.95		
Almost Free PC Volume 14 (AFSPC14)	\$19.95		
Almost Free PC Volume 15 (AFSPC15)	\$19.95		
Almost Free PC Volume 16 (AFSPC16)	\$19.95		
Almost Free PC Volume 17 (AFSPC17)	\$19.95		
Almost Free PC Volume 18 (AFSPC18)	\$19.95		
Almost Free PC Volume 19 (AFSPC19)	\$19.95		
Almost Free PC Volume 20 (AFSPC20)	\$19.95		
Almost Free PC Volume 21 (AFSPC21)	\$19.95		
Almost Free PC Volume 22 (AFSPC22)	\$19.95		
Almost Free PC Volume 23 (AFSPC23)	\$29.95		
Almost Free PC Volume 24 (AFSPC24)	\$19.95		
Almost Free PC Volume 25 (AFSPC25)	\$19.95		
Almost Free PC Volume 26 (AFSPC26)	\$19.95		
Almost Free PC Volume 27 (AFSPC27)	\$19.95		
Almost Free PC Volume 28 (AFSPC28)	\$19.95		
Almost Free PC Volume 29 (AFSPC29)	\$19.95		
Almost Free PC Volume 30 (AFSPC30)	\$19.95		
Almost Free PC Volume 31 (AFSPC31)	\$19.95		
Almost Free PC Volume 32 (AFSPC32)	\$19.95		
Almost Free PC Volume 33 (AFSPC33)	\$19.95		
Almost Free PC Volume 34 (AFSPC34)	\$19.95		
Almost Free PC Volume 35 (AFSPC35)	\$19.95		
Almost Free PC Volume 36 (AFSPC36)	\$19.95		
Almost Free PC Volume 37 (AFSPC37)	\$19.95		
Almost Free PC Volume 38 (AFSPC38)	\$19.95		
Almost Free PC Volume 39 (AFSPC39)	\$19.95		
Almost Free PC Volume 40 (AFSPC40)	\$19.95		
Almost Free PC Volume 41 (AFSPC41)	\$19.95		
Almost Free PC Volume 42 (AFSPC42)	\$19.95		
Almost Free PC Volume 43 (AFSPC43)	\$19.95		
Almost Free PC Volume 44 (AFSPC44)	\$19.95		
Almost Free PC Volume 45 (AFSPC45)	\$19.95		
Almost Free PC Volume 46 (AFSPC46)	\$19.95		
Almost Free PC Volume 47 (AFSPC47)	\$19.95		
Almost Free PC Volume 48 (AFSPC48)	\$19.95		
Almost Free PC Volume 49 (AFSPC49)	\$24.95		
Hard Disk Survival Kit (AFSHD)	\$19.95		
Almost Free Business Software (BUSN1)	\$19.95		
Ventura Survival Disk Volume 1 (AFVENT1)	\$19.95		
SuperDisk Volume 1 (utilities) (SD1)	\$19.95		
SuperDisk Volume 2 (games) (SD2)	\$19.95		
SuperDisk Volume 3 (dBase utilities) (SD3)	\$19.95		
SuperDisk Volume 4 (utilities) (SD4)	\$19.95		
SuperDisk Volume 5 (business) (SD5)	\$19.95		
SuperDisk Volume 6 (games) (SD6)	\$19.95		
SuperDisk Volume 7 (games) (SD7)	\$19.95		
SuperDisk Volume 8 (productivity) (SD8)	\$19.95		
SuperDisk Volume 9 (1-2-3 utilities) (SD9)	\$19.95		
Leisure Library Volume 1 (LL1)	\$19.95		
Leisure Library Volume 2 (LL2)	\$19.95		
Leisure Library Volume 3 (LL3)	\$19.95		
LaserJet Fonts Volume 1 (AFLJ1)	\$19.95		
Games Disk Volume 1 (AFGAMES1)	\$19.95		
Games Disk Volume 2 (AFGAMES2)	\$19.95		
Games Disk Volume 3 (AFGAMES3)	\$19.95		
Executive Software Series Volume 1 (EXEC1)	\$19.95		
Executive Software Series Volume 2 (EXEC2)	\$19.95		
Executive Software Series Volume 3 (EXEC3)	\$19.95		
Executive Software Series Volume 4 (EXEC4)	\$19.95		
Executive Software Series Volume 5 (EXEC5)	\$19.95		
Executive Software Series Volume 6 (EXEC6)	\$19.95		
Executive Software Series Volume 7 (EXEC7)	\$24.95		
Electronics & Technology Series Volume 1 (ETT1)	\$19.95		
Almost Free DX-7 Voices (AFDX7)	\$19.95		



FORMAT: _____ 5.25" disks will be shipped unless otherwise instructed.

CLIPART

TITLE	PRICE	QTY	AMOUNT
Specify PC or Macintosh format:			
Ventura ClipArt Volume 1 (AFCLIP1)	\$19.95		
Ventura ClipArt Volume 2 (AFCLIP2)	\$19.95		
Ventura ClipArt Volume 3 (AFCLIP3)	\$19.95		
Ventura ClipArt Volume 4 (AFCLIP4)	\$19.95		
Ventura ClipArt Volume 5 (AFCLIP5)	\$19.95		
Ventura ClipArt Volume 6 (AFCLIP6)	\$19.95		
Ventura ClipArt Volume 7 (AFCLIP7)	\$19.95		
Ventura ClipArt Volume 8 (AFCLIP8)	\$19.95		
Ventura ClipArt Volume 9 (AFCLIP9)	\$19.95		
Ventura ClipArt Volume 10 (AFCLIP10)	\$19.95		
LaserArt Volume 1 (AFLASER1)	\$19.95		
COLOUR CLIPART			
Volume 1 GIF® Images (specify format)* (AFGIF1)	\$19.95*		
PC PaintBrush® Comp. (specify format)* (AFPCX1)	\$29.95*		
Volume 2 GIF® Images (specify format)* (AFGIF2)	\$19.95*		
Volume 3 GIF® Images (specify format)* (AFGIF3)	\$19.95*		

*On 1.2 megabyte disks. \$31.95 on dual density 360K disks

MACINTOSH

Almost Free Macintosh Volume 1 (AFMAC1)	\$24.95	
Almost Free Macintosh Volume 2 (AFMAC2)	\$24.95	
Almost Free Macintosh Volume 3 (AFMAC3)	\$24.95	
Almost Free Macintosh Volume 4 (AFMAC4)	\$24.95	
Almost Free Macintosh Volume 5 (AFMAC5)	\$24.95	
Almost Free Macintosh Volume 6 (AFMAC6)	\$24.95	

SUBTOTAL: _____

8% P.S.T. (Ontario residents): _____

POSTAGE & HANDLING (\$1.50): _____

TOTAL: _____

CUSTOMERPOLICY: This software has been collected from public access bulletin boards and/or has been placed directly in the public domain by its authors. It is all believed to be in the public domain, or offered as "shareware". As shareware, users of these programs are requested to pay registration fees to their authors, which may entitle you to additional updates, support and documentation. Note that the fee charged for this disk defers our cost in collecting and distributing the software only, it does not replace any requested shareware contributions. This will help to ensure a continuing supply of high quality shareware available at reasonable prices. If you try out this disk, and do not feel that it is fair value, you may return it for a refund or exchange it for a different disk with no questions asked. We do not sell software to people who cannot use it. If you have trouble with disk, you are welcome to call our free technical support service at (416) 445-5600 during normal business hours. Please be prepared to tell us the exact make and model of your computer and the disk and program you are having difficulty with. Please note that we cannot be responsible for any loss, damage or expense resulting from your use of this software, however caused. If you are unable to read your disk, it has probably been corrupted in the mail. You need not call us in this case. Simply return the disk to our software department with a note requesting a replacement. It will be shipped immediately. Please note that these disks do presuppose a reasonable familiarity with your computer. If you are very new to your system, we strongly recommend that you familiarize yourself with it before attempting to use this software.

NAME _____

COMPANY _____

ADDRESS _____

CITY _____

PROVINCE _____

POSTAL CODE _____

PHONE _____

SUBSCRIBER? ☐ CN! ☐ ETT ☐ CIE

☐ CHEQUE ENCLOSED ☐ PLEASE CHARGE MY:

☐ VISA ☐ AMERICAN EXPRESS ☐ MASTERCARD

CARD NUMBER _____

EXPIRY DATE _____

SIGNATURE _____

SEND TO:

MOORSHEAD PUBLICATIONS

1300 Don Mills Road, North York, Ontario M3B 3M8

(416)445-5600 FAX: 416-445-8149.

ATI VGA EGA ETC

EMJ

When you want ATI, look first to EMJ

If you're familiar with the high standards of ATI's Graphics boards, plus ATI's excellent modems, then you should get to know the highest standard in ATI selection and service at EMJ.

EMJ Data Systems. We're Canada's High Performance Distributor because we treat each and every customer the only way we know how. With honesty, courtesy and with

excellent support and value on computer products that people ask for from coast to coast.

Call EMJ today to find out more about our great service and support on our top quality line-up of ATI products. You'll soon see what EMJ care and competence is all about.

EGA WONDER
Any Software. Any Monitor. Any Time.

EGA WONDER 800
Any Software. Any Monitor. Any Time.

2400etc
The Next Generation in Modems

Graphics Solution

ATI
TECHNOLOGIES INC.
Technology you can Trust.

EMJ

Data Systems Ltd.

HEAD OFFICE:
GUELPH
(519) 837-2444
FAX (519) 836-1914

BRANCHES:
Vancouver
(604) 875-9344
FAX (604) 875-6393

Calgary
(403) 229-1535
FAX (403) 244-4469

Winnipeg
(204) 949-0055
FAX (204) 949-0063

Toronto
(416) 454-2940

Montreal
(514) 745-4500
FAX (514) 745-2886

Halifax
(902) 835-1621
FAX (902) 835-9127

*TOLL FREE (Man., Ont., Que., N.B., N.S., P.E.I.): 1-800-265-7212

(BC, Alta.): 1-800-663-9048

Circle No. 99 on Reader Service Card

Now from NRI comes the first course of its kind . . . anywhere!

Learn to use, program, and service today's digital electronic music equipment as you build your own computer-controlled music center



Now NRI puts you at the heart of the most exciting application of digital technology to date! With NRI's new at-home training in Electronic Music Technology, you get hands-on experience with the equipment that's revolutionizing the music industry—Atari ST Series computer with built-in MIDI ports, Casio CZ101 digital synthesizer with advanced MIDI capabilities, and ingenious MIDI software that links computer keyboard to synthesizer keyboard—all yours to train with and keep.

This year, over \$1.5 billion worth of digital electronic music instruments—keyboards, guitars, drum machines, and related equipment—will be sold in the U.S. alone. Who's buying this new-tech equipment? Not just progressive musicians and professional recording technicians, but also thousands of people who have never touched a musical instrument before. And there's good reason why.

Something called MIDI (Musical Instrument Digital Interface) has suddenly transformed musical instruments into the ultimate computer peripherals . . . and opened up a whole new world of opportunity for the person who knows how to use, program, and service this extraordinary new digital equipment.

Now NRI's breakthrough Electronic Music Technology course puts you at the forefront of this booming new technology with exclusive hands-on training built around a MIDI-equipped computer, MIDI synthesizer, and MIDI software you keep.

Dynamic New Technology Opens Up New Career Opportunities for You

The opportunities are unlimited for the person who's trained to take advantage of today's electronic music phenomenon. Now you can prepare for a high-paying career as a studio technician,

sound engineer, recording engineer, or road technician . . . even start your own new-age business providing one-stop sales and service for musicians, technicians, and general consumers alike. Or simply unleash your own musical creativity with the breakthrough training and equipment only NRI gives you.

Only NRI Gives You an Atari ST Computer, Casio Synthesizer, and Innovative MIDI Software You Train With and Keep

The Atari ST Series computer included in your course becomes the heart of your own computer-controlled music center. With its tremendous power, superior graphics capabilities, and built-in MIDI interface, the 16/32-bit Atari ST has almost overnight become the computer of choice for today's most knowledgeable electronic musicians.

The Casio CZ101 digital synthesizer, also included in your training, is the perfect complement to your Atari ST. The polyphonic, multitimbral CZ101—which stores up to 32 voices internally—"communicates" with your ST computer through MIDI, bringing life to virtually any sound you can imagine.

Plus, you get ingeniously designed MIDI software that opens up amazing new creative and technical possibilities . . . you actually build your own 4-input audio mixer/amplifier . . . and you test the electronic circuits at the core of today's new-tech equipment with the hand-held digital multi-meter included in your course.

No previous experience necessary—in electronics or music!

No matter what your background, NRI gives you the skills you need

to take advantage of today's opportunities in electronic music technology.

With your experienced NRI instructor always available to help, you master the basics of electronic theory step by step, gaining the full understanding of electronics that's now so essential for technicians and musicians alike. You move on to analyze sound generation techniques, digital logic, microprocessor fundamentals, and sampling and recording techniques . . . ultimately getting first-hand experience with today's explosive new technology as you explore MIDI, waveshaping, patching, sequencing, mixing, special effects, and much more.

Plus, even if you've never been involved with music before, NRI gives you enough basic training in music theory and musical notation to appreciate the creative potential and far-reaching applications of today's electronic music equipment.

Send Today for Your FREE Catalog

For all the details about NRI's innovative new training, send the coupon today. You'll receive a complete catalog describing NRI's Electronic Music Technology course plus NRI courses in other high-tech, in-demand electronics fields.

If the coupon is missing, write to NRI School of Electronics, McGraw-Hill Continuing Education Center, 3939 Wisconsin Avenue, Washington, DC 20016.

NRI School of Electronics

McGraw-Hill Continuing Education Center
330 Progress Avenue, Scarborough, Ontario M1P 2Z5
Main Office: 3939 Wisconsin Avenue, NW, Washington, DC 20016

☒ **CHECK ONE FREE CATALOG ONLY**

- | | |
|--|--|
| <input type="checkbox"/> Electronic Music Technology | <input type="checkbox"/> Computers and Microprocessors |
| <input type="checkbox"/> TV/Video/Audio Servicing | <input type="checkbox"/> Basic Electronics |

Name (Please Print) _____ Age _____

Street _____ Telephone _____

City/Prov./Code _____
We'll give you tomorrow.

Member of Private Career Education Council

11-079

PC Hardware Interfacing Part 6

With parallel ports pretty well beaten into submission, this month we're going to look at the rudiments of that most vexing sort of interface, the serial port.

STEVE RIMMER

Last month we looked at the 8255 parallel port chip, a wonderful chunk of silicon which replaces all sorts of discrete logic. In the months to come we'll look at the details of actually using this chip in a real word PC interface. However, before we get into the grotty details of wiring up one of these monsters, it makes some sense to look at the other sort of commonly found PC interface, the serial port.

Serial ports are equally as common as parallel ports on most PC's, and in many respects they're more useful. A greater number of peripherals are equipped with serial ports... excluding the exotic boxes and trolls, serial ports allow us to talk to things like laser printers, mice, modems and other PC's.

The important thing to realize about serial ports is that they allow data to flow in both directions, whereas parallel ports only send data out of the computer. In theory there is no reason why this should be so, but the conventions of personal computers at the moment do not use the standard parallel interface for bidirectional data transfer.

Actually, there is one good reason. A standard serial port allows data to flow in both directions at once. A standard parallel interface... even if it's tricked into accepting input as well as output... only allows for data flowing one way at a time. Changing directions would require some sort of handshaking to make sure that both ends of the conversation don't start talking at once.

If you're designing a custom interface for a custom peripheral, of course, you are free to use whatever sort of port you like. However, there is a lot to be said for using an interface design which already exists.

The other useful aspect of serial ports is that they can move data over fewer wires. A parallel port cable is an ugly great ribbon with all sorts of data lines, handshaking lines and so on. Even the simple ports we've looked at in this series have required eight data lines, a ground line and usually a handshaking line. Unidirectional data over a serial link requires but two wires. Bidirectional data can get by with three, although at high speeds it's very often desirable to have more than this.

This month we'll take a look at the

basics of serial ports and have a quick introduction to the chip that makes them possible.

Bytes Bitten Sideways

Figure 1 shows a basic serial port. Now, this looks ridiculously crude, being all mechanical, but this is actually how serial data was transmitted back thirty years ago, before large scale integration was particularly common.

As we've seen in previous months, we can represent a byte of data as eight wires, or lines, each line having either zero volts or some arbitrary positive voltage on it. The zero volt ones are said to have logic values of zero, and the positive ones logic values one one.

If we use a mechanical switch like the one shown here to step the values on the wires onto a common line one bit at a time, the result will be serial data of a sort. In theory, a similar switch at the far end of the serial line could re-assemble the serial byte into a parallel byte.

In practice, there is a lot more to it than this. The two mechanical switches would have to be synchronized somehow, such that

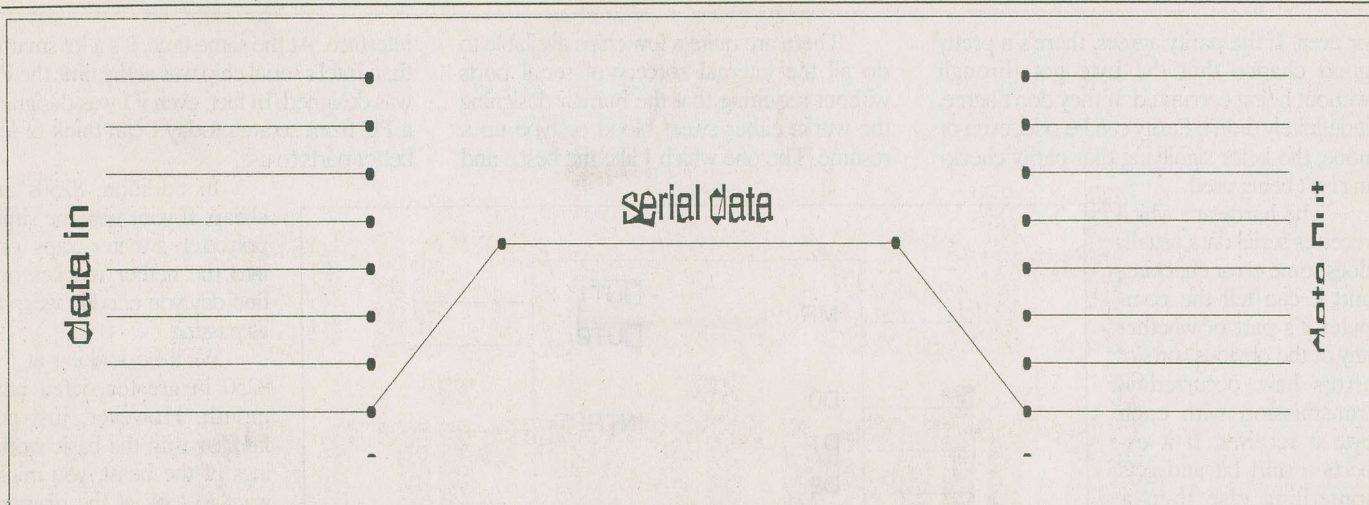


Figure 1. A very crude serial link. Parts for this project are no longer available... fortunately.

when the sending switch was sending bit zero, the receiving switch would be connected to line zero of the receiving parallel port. One could arrive at this by having a long metal rod between the two switches, such that they both rotated together, although the usefulness of a serial link seems to fall apart at this point.

In the real world, serial data is not generated mechanically, of course, or at least, it hasn't been for a very long time. In using data levels which come out of transistors, it's possible to generate a much more sophisticated, and much faster, serial data format.

In order to allow the receiving end of a serial conversation to know what's going on at the sending end, it's necessary to establish a "protocol" which defines how the data is going to be sent. The protocol defines a number of things about the structure of the serial bits. This is what a serial protocol tells us.

- Is the transmission synchronous or asynchronous?
- What is the speed (baud rate)?
- How many bits in a byte?
- How many stop bits in a character?
- What parity is being used?

This probably doesn't make a lot of sense just yet. Read on.

Baudy Tales

The first question in the above list, whether the transmission is synchronous or asynchronous, is one which users of PC's rarely have to answer. The serial port which is commonly found on a PC, the RS-232C port, is always asynchronous. Synchronous serial transmission involves sending not only data over the serial link, but also a common clock signal, such that the sender and the

receiver agree on exactly when each pulse on the data line will begin and end. A synchronous serial port can be much faster for this reason, although it requires more hardware and more wire to move synchronous data around. The sorts of speeds which asynchronous ports are capable of are usually suitable for microcomputers, and one usually only sees asynchronous ports on PC's if they're intended to talk to mainframe computers.

You may want to implement a synchronous port in a custom interfacing application if you have to move a lot of data around in a large hurry.

The speed of data through a serial interface is called the baud rate, a term which you'll probably have heard before. The baud rate is the number of bits of data which move through the interface in a second. As we'll see in just a moment, this is usually more than eight bits per character.

The baud rate can be any speed you like, although there are a number of fairly common standard baud rates. These are shown here.

- 45,45 baud - old Baudot teletypes
- 300 baud - very slow modems
- 1200 baud - less slow modems, some printers
- 2400 baud - only mildly slow modems
- 9600 baud - fast modems, laser printers
- 14,000 baud - USR HST modems
- 19,200 baud - fast laser printers
- 56,400 baud - intersystem hard wired links

For practical purposes, 56,400 baud is the upper limit of the hardware in a standard PC serial port. This may also be pretty close to the red line for many old style first generation PC compatibles which, even if

they were equipped with hardware which could handle faster data, would have a hard time keeping up with it.

The number of bits in a byte will usually be seven or eight. Eight bit bytes are required if we wish to transfer programs or other full byte characters through the port, and virtually all serial communications are handled with eight bit characters. Seven bit characters are used when all we want to send is straight ASCII, which only has seven significant bits. This means that we save one bit per character. If a character has ten actual bits, this represents a ten percent increase in the throughput of the port.

The aforementioned old Baudot teletypes only required sixty four possible combinations for their data, so they had five bit characters.

In order for the receiving port to know when a character's bits start, it's necessary to "frame" each eight bit character with a start bit and one or more stop bits. These framing bits are electrically different from data bits, so that if the integrity of the serial line between two devices gets temporarily mangled, the receiving port can resynchronize itself by simply throwing away all the bits it gets until it identifies a start bit.

There is always a single start bit, so we needn't speak of this. There can be one or two stop bits.

Finally, each byte sent over the link has a parity bit. This is a check to allow the receiving port to know whether the character it has received is what was actually sent. Actually, it's more of an educated guess. The parity bit simply tells the receiving port whether the sending port thought that the ASCII value of the character sent was odd

PC Hardware Interfacing, Part 7

or even. If the parity agrees, there's a pretty good chance that the byte got through without being corrupted. If they don't agree, it definitely didn't. Parity can be odd, even or none, the latter signifying that parity checking isn't being used.

The hardware which receives serial data usually does some error checking, and it can tell the computer it's part of whether any of the obvious sorts of errors have occurred in transmission with each byte it receives. If it expects a start bit and gets something else then a framing error has occurred. If it doesn't find the parity it expects then a parity error has occurred.... and so on. It's up to the computer to take the appropriate action to deal with these errors.

Usually there is no appropriate action. Data which has been mangled cannot usually be unmangled.

A common protocol is 9600 baud, eight bits of data, no parity and one stop bit for ten bits per transmitted character. This means that, at this speed, 960 actual bytes of data would move over the link in a second. It would take less than three seconds for all the raw data on a text screen to be sent over the serial port. A stock 4.77 megahertz PC redraws its screen through BIOS calls at less than this speed.

Chips From Hell

If you've been mentally designing circuitry to handle all the stuff we've just been talking about, your head will now be full of wires. Compared to the relatively tame hardware of a parallel port, a serial port is an engineer's nightmare. The only reason that hardware designers were ever able to implement them before dedicated serial port chips became common was because they'd have been fired if they hadn't.

There are quite a few chips available to do all the internal sorcery of serial ports without requiring that the human designing the works either sweat blood or type up a resumé. The one which I like the best... and

interface. At the same time, it's a lot smarter than Intel's serial chip was at the time the PC was designed. In fact, even if I was designing a PC from scratch today I can think of few better parts to use.

In addition, 8250s are cheap. If your genuine virgin polyester sweater zaps one into the nether reaches one fine day you needn't weep at its passing.

We'll be looking at the 8250 in greater detail next month. However, just get familiar with the basic workings of the beast, you might want to look at the diagram in figure two. It's not as horrible as it seems. The wonderful thing about the 8250... especially when you start actually trying to write software to drive one... is that it can be programmed quite crudely and then improved upon once you're sure it's working.

We'll leave the programming of the chip for another time.

If you peer at it for a moment, most of the 8250's pin consignment will prove to be pretty familiar. It does things in much the same way that we saw the 8255 parallel port chip doing them last month. The address and data lines behave in the same ways... the 8250 uses a range of ports to communicate with its host computer, just as the 8255 did. The lines which may require detailed explanations are few.

The MR line is the master reset. Pulling this line resets the 8250 to its default state. Since the chip comes up, when power is first applied to it, with garbage in its registers, it is essential that it be reset before anything sensible is expected of it. The RESET line of the PC's bus handles this.

The DISTR and DOSTR lines... and their negated complements... are the data direction lines for the chip's communication with the PC's bus. They come in both polarities because the 8250 was designed to interface to as many different processors as possible. The PC uses the negated

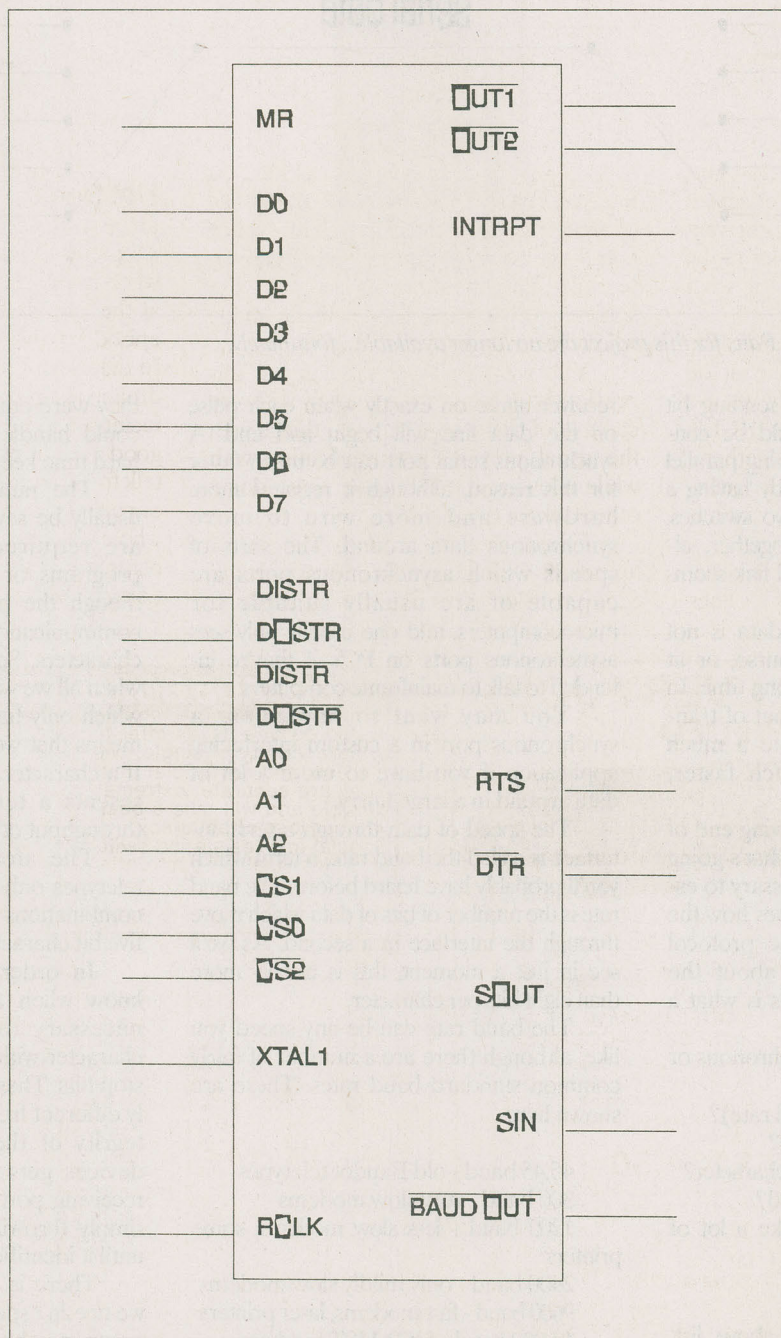


Figure 2. A simplified printout of the B260, suitable for framing.

the one which is found in the IBM PC's standard asynchronous serial port circuitry... is the Western Digital 8250. This chip has the advantage that it looks very much like an Intel part to the hardware which is driving it... all the rest of which actually comes from Intel in a PC... so it's wonderfully simple to

lines... the positive going versions are tied low. When the processor wants to write data to the 8250, it pulls **DISTR**. When it wants to read data, it pulls **DOSTR**. These correspond to the **TOR** and **IOW** lines of the PC's bus.

The **CS** lines are the chip select. Again, they come in both flavours to facilitate painless interfacing to different sorts of processors. The positive lines... **CS0** and **CS1**... get tied high through a small resistor on a PC. The inverted line, **CS2**, enables the chip when its range of ports has been addressed. You might want to look at the port address decoder in the first installment of this series to see what this is about.

The **XTALI** line is, obviously, the input from a crystal clock. To make all the baud rates work out conveniently we use an 18.432 megahertz clock. The **RCLK** and **BAUD OUT** lines get tied together... this facility allows for an external frequency divider in the baud clock loop, which is ordinarily not required.

The **SIN** and **SOUT** lines are serial data in and out. The **DTR** and **RTS** lines

are involved with serial hardware handshaking, which we'll speak of at greater length later on.

Finally, there are two really useful sets of lines which make the 8250 such a powerful chip. The **INTRPT** line can be programmed to go high every time the 8250 has a character to received, every time it has nothing to do and could be sending a character and every time it encounters an error. Assuming that it is set to blast off for all of these conditions, an internal register in the 8250 allows the computer deriving the chip to know which condition has triggered any particular interrupt. The result of this is that the software driving the 8250 can be made wholly interrupt driven.

You will recall our speaking of this previously. It makes the driving software capable of doing sophisticated things with the serial port it's communicating with while allowing the PC to continue doing other tasks at the same time.

Finally, the lines **OUT1** and **OUT2** are general purpose I/O lines which the 8250 provides us for controlling anything

we feel like controlling. The state of these lines can be programmed using the chip's internal registers. This allows the 8250, for example, to manually pulse dial a phone line, flash an LED when it encounters an error, turn on a fourteen megawatt siren when a serial connection has been broken... through a suitable fourteen megawatt relay, of course... and so on. These come in really handy in dedicated interface applications.

Hot Serial

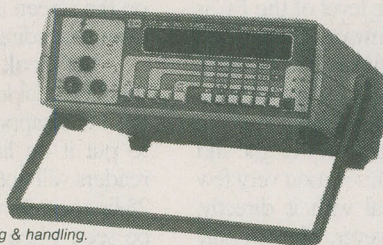
Once you understand how the 8250 works, it's pretty simple to actually make it work when interfaced to a PC. We'll be looking at the hardware to do so in an upcoming episode of this long and complicated tale. In the mean time, you might want to start dreaming up some things that need interfacing to. By now, you should have a pretty good idea of exactly what a PC is able to talk to. Short of yaks and some rare species of partially extinct carburetors, there isn't a whole lot which *can't* be interfaced to a computer if you can concoct a reason for doing so. ■

METERS FOR EVERY JOB! VALUE PRICED

MODEL GDM-8035 DIGITAL BENCH MULTIMETER

Six functions including AC/DC voltage, AC/DC current, resistance and diode test, 20A high current range and 1200V high voltage range, accuracy 0.1%. Circuit protected, seven segment LED display.

\$325. Plus \$10 for shipping & handling.



MODEL HC-4510 4-1/2 DIGIT ACCURACY

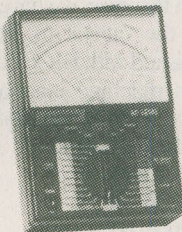
200mV to 750V AC, 200mV to 1000V DC and 2mA to 10A AC/DC currents plus resistance 20 ohm to 20M ohm. Overload protected, 9V battery included.

\$134.50

Carrying case: add \$10.00.
Plus \$5 for shipping & handling.



HC-4510



HC-5050E

HC-5050E DELUXE ANALOG MULTIMETER

14 DC volt ranges to 1200V and 13 AC ranges to 3300V plus AC/DC currents, DC resistance and dB. Accuracy 2.5% DC and 3.5% AC. Complete with carrying case.

\$59.95

Plus \$5 for shipping & handling.
CSA approved where applicable.



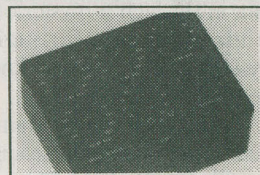
Order by phone or mail. Credit card, money order, cert. cheque or C.O.D. Ontario residents add 8% P.S.T.

KB ELECTRONICS

1428 Speers Rd., Oakville, ON L6L 5M1
Tel. (416) 847-8588 FAX (416) 847-8598

DECADE BOXES FROM DAETRON

These decade boxes offer the user a large variety of single, two, four, five, six and seven dial units. They are accurate, extremely durable and will take a beating without loss of accuracy. Special low resistance switches and high quality construction assure long life.



PART	DIALS	ACCUR.	RANGE	STEPS	PRICE	QTY & PRICE
RESISTANCE						
DR-15	2	1%	0 to 110	1 ohm	129.95	— \$
DR-23	2	1%	0 to 11K	100 ohms	125.95	— \$
DR-31	2	1%	0 to 1.1M	10K ohms	134.95	— \$
DR-41	6	1%	0 to 1.1M	1 ohm	169.95	— \$
DR-51	6	0.5%	0 to 1.1M	1 ohm	214.95	— \$
DR-55	6	0.1%	0 to 11.11M	10 ohms	269.95	— \$
DR-61	7	1%	0 to 11.11M	1 ohm	449.95	— \$
DR-71	7	0.5%	0 to 11.11M	1 ohm	509.95	— \$
CAPACITANCE						
DC-13	2	1%	0 to 0.011 uF	100 pF	119.95	— \$
DC-23	2	1%	0 to 1.1 uF	0.01 uF	142.95	— \$
DC-33	1	1%	0 to 10.0 uF	1.0 uF	169.95	— \$
DC-43	2	1%	0 to 0.0011 uF	10 pF	125.95	— \$
DC-53	5	1%	0 to 1.1 uF	10 pF	252.95	— \$
INDUCTANCE						
DL-12	1	2%	0 to 10 mH	1.0 mH	185.95	— \$
DL-22	1	2%	0 to 100 mH	10.0 mH	165.95	— \$
DL-32	1	2%	0 to 1.0 H	100.0 mH	179.95	— \$
DL-42	1	2%	0 to 10.0 H	1.0 H	189.95	— \$
Shipping add 3% for mail or UPS, 10% courier (unless collect)						
Visa, Mastercard or Check					Ont. res. add 8% PST	\$
SIGNATURE			CARD NO.		EX. DATE	
NAME			Pos. Code		Tel. No.	
ADDRESS			CITY		PROV	



DAETRON
P.O. BOX 641 STATION 'U', TORONTO ONT. M8Z 5Y9
(416) 676-1600

Techie's Guide to C Programming Part 6

This month we're going to get a bit less dignified about C and discuss some of the dirty tricks ones has to play on the PC to make it work out right.

STEVE RIMMER

In its most perfect and useless state, C is a pure language. It can't play music, it can't print in red text and it can't draw bar graphs. All it can do is process. It takes data in through a mysterious channel and sends data out through an equally mysterious channel and knows nothing of the world beyond its door.

This is C on a mainframe. Anyone who tried to get away with selling a C compiler like this for the IBM PC would be hooted out of the known universe, of course.

In order to make C into a language which is actually good for something, the designers of PC-based compilers for it always wind up adding huge collections of functions which relate specifically to the PC's peculiar hardware. These handle things like fast screen updating, sound and graphics as well as a dedicated interface to the PC's operating system and BIOS.

It's useful to know how to make these things work because, while they represent the cheapest, nastiest, most reprehensible and ill-behaved aspects of C programming, they are essential to writing programs which actually work.

This month we're going to look at some dirty tricks. Some of these things are specific to Turbo C, but you'll find nearly identical functions in most other popular PC based C compilers.

Vas Ist DOS?

There are two levels of machine specific

dirty tricks under C. The low level tricks give you access to the machine's guts. The high level tricks let you do hardware specific things, such as graphics. We'll deal with the low level things here.

The lowest software level of the PC is its BIOS. This is the firmware which starts up the computer and makes it do simple tasks, such as fetching a keyboard character or printing a byte to the screen.

The PC's BIOS is not very bright and extremely slow, and for this reason very few applications have to deal with it directly. There are occasions, however, wherein only the BIOS can help you. C on the PC provides an interface directly to the BIOS.

The BIOS provides a number of groups of functions, all of which are gotten at through software interrupts. These are roughly grouped together by interrupt number. It isn't really necessary to know how interrupts work or even what they do, so long as you know what the BIOS is up to and what numbers to put in the appropriate places to make it do its thing.

In order to make the BIOS get up and dance, from any language which supports calling it, you will need a listing of its entry points. The best one of these which I've encountered to date is *IBM ROM BIOS* by Ray Duncan, published by Microsoft. Read through it carefully and computers will never trouble you again — your eyes will be too shot to see them.

The most useful BIOS function is 10H,

which deals with the screen. Ordinarily you will not want to use this to print characters to the screen because it's too slow. However, there are several areas in which it can be of considerable use. It can position the cursor on the screen and it can scroll or clear windows exceedingly quickly.

Let's look at a simple problem. One of the few reliable ways to make the cursor of the PC disappear from within a program is to put it on line 26 of the screen. Astute readers will note that there is no line 26 on a 25-line screen, which is why the cursor can't be seen when it's down there. This works well, except that the screen position functions found in most C compilers, usually *gotaxy*, won't allow you to pass them illegal values.

In this case, we have to use the BIOS to move the cursor to line 26. This is accomplished with BIOS call 10H, function 2.

In machine language, this would be done with the following bit of code.

```
MOVAH,0FH
INT10H
MOVAH,02
MOV DX,1A00H
INT10H
```

Hands up everyone who made any sense of this at all.

The first rule of low level calls to the PC's guts is that they're never even marginally intelligible without a bit of inside information.

NEXT MONTH IN

Electronics & Technology Today



What's New In Video

Super VHS? High-definition? 8mm? We take a look at some of the recent advancements in video technology and provide some answers. Also, a look at some of the new features in VCRs and camcorders.

Build a Signal Injector

Add tones to the circuit you're troubleshooting and you can trace the circuit action with a scope or earphone.

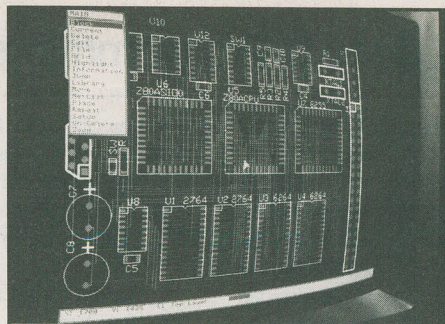
The PCs as Logic Analyzer

Logic analyzer are usually very expensive, but much of the cost can be eliminated by using a PC to do the actual processing. Some tips and techniques.

Plus, of course, the usual projects, articles and news!

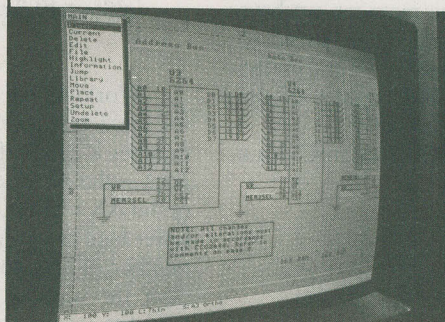
Subscribe today!

For advertising or subscriptions, please call (416) 445-5600, FAX 445-8149.



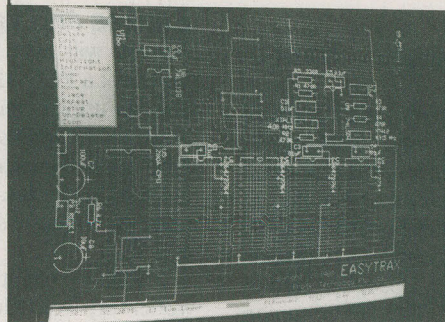
PROTEL-AUTOTRAX \$995

Full-featured professional PCB layout for both through-hole and SMD designs. Auto component placement from Netlists. Interactive and Full Autorouting. Support for popular printing/plotting formats including Gerber format photoplots. Supports up to 4MB of expanded memory.



PROTEL-SCHEMATIC \$495

Flexible, easy to use schematic capture program for both digital and analog circuit designs. Netlist transfer to PROTEL-AUTOTRAX completes a powerful end-to-end circuit board design system.



PROTEL-EASYTRAX ~~\$495~~

Easy to learn, easy to use manual PCB design package. Capable of producing professional artwork for multi-layer, through-hole boards to 32 x 32 inches. Host of powerful editing features make efficient PCB layout a breeze. Gerber and NC Drill output.

HARDWARE: IBM PC/AT/XT/PS2 or compatibles...640K RAM... 2 floppies or a hard disk...PC or MS-DOS greater than version 2.0

TO ORDER TOLL FREE (800) 544-4186
If you're in CA, HI, AK, Canada, call: (408)437-7771

PROTEL TECHNOLOGY INC.

50 Airport Parkway
San Jose, CA 95110

A Member Company of Critic Corporation
(408) 437-7771
fax (408)-437-4913



TOP OF THE LINE IN PCB DESIGN

QUICK START CIRCUIT DESIGN

EASY LOW-COST PCB DESIGN

INTRO PRICE \$395

Techie's Guide to C Programming, Part 7

The definition of the cursor mover call of the BIOS says that the AH register has to contain the number 2, since this is BIOS function 2. This accounts for the line MOV AH,02. The DH register is to contain the vertical position and the DL register the horizontal position. These two registers can be combined into the DX register. The horizontal position will be zero. The vertical position will be 26. In hexadecimal, 26 is represented by the number 1AH. Hence, we MOV DX,1A00H.

The BH register is supposed to hold the video page number. The CGA card, for example, actually has four pages of video memory. In order to find out which of these is in use at the moment, we have to use a second BIOS call before we get to the first one. Function 0FH returns the page number in the BH register of the processor, just where we want it.

Let's see how this is done in C. It's a bit easier.

```
HideCursor()
{
    union REGS r;

    r.x.ax = 0x0f00;
    int86(0x10,&r,&r);

    r.x.ax = 0x0200;
    r.x.dx = 0x1a00;
    int86(0x10,&r,&r);
}
```

I said it was a bit simpler — not blindly clear.

C provides us with a function called *int86*, which simply executes software interrupts. Its first argument is the number of the interrupt we want executed, as found in the ROM BIOS book or in some other suitable list. Its second and third arguments are pointers to a peculiar kind of struct called a "union". The REGS union is defined in the DOS.H file of your compiler. It just holds the values of all the important machine registers. The second argument is the registers going into the call and the third one is the registers coming out. It's allowable to return the registers in the same REGS variable as they start in, as we've done here.

We'll look at the notation of unions in greater detail later on in this series. For now, you can apply this approach to having your C program throw any software interrupt you have a need of.

Here's a slightly more involved example of a BIOS call. This routine scrolls a window on the screen up by a defined

number of lines. If the number of lines is zero, the window is blanked. We'll assume that the screen text is in white on black text, which has a screen attribute of 07H. We'll discuss this in a future episode too.

```
ScrollUp(left,top,right,bottom,how_much);
int left,top,right,bottom,how_much;
{
    union REGS r;

    r.x.ax = 0x0600h + how_much;
    r.x.bx = 0x0700;
    r.x.cx = (top * 256) + left;
    r.x.dx = (bottom * 256) + right;
    int86(0x10,&r,&r);
}
```

Working backwards, the definition for this interrupt tells us that its function number is 6. The function number always goes in the AH register, or the upper byte of the AX register. The AL register, or the lower byte of the AX register, contains the number of lines to scroll up by or zero to clear the window. The BH register contains the screen attribute for the window, seven in this case.

The CL and CH registers contain the horizontal and vertical co-ordinates for the upper left corner of the window. The DL and DH registers contain the co-ordinates for the lower right corner.

Snakes and Ladders

As you will have noted, printing to the screen of a PC in the "correct" way, which involves using several interrupt calls strung together, is tediously slow. The way which most applications manage it is to locate the memory where the screen display lives and poke the requisite screen text right into the buffer.

This is cheating, of course, but it works very well. Most C compilers feature high speed screen printing which is a lot more elegant than what we're going to look at here. However, being able to treat the screen just like another chunk of memory has its uses.

In order to do high speed screen access from C, we have to be able to find the screen and figure out which locations correspond to which characters. Regrettably, the screen memory moves around depending on what sort of display card is in memory. CGA, EGA and VGA cards place it at segment B800H. Hercules cards put it at segment B000H.

A segment is just part of a memory address, as we'll see.

In order to find out where the screen memory is, we have to find out what sort of card is in the computer our program is running on. We can do this with a BIOS call.

```
ScreenSegment()
{
    union REGS r;

    int86(0x11,&r,&r);

    if((r.x.ax & 0x00c0) == 0x00c0)
        return(0xb000);
    else return(0xb800);
}
```

This uses a different BIOS call, interrupt 11H. This interrupt returns a word in the AX register with bits that indicate whether there's a math coprocessor in the machine, how many floppy drives are on line and what the video card type is. In essence, it reads the configuration DIP switches. If bits four and five are both set, we have a monochrome or a Hercules card. If they aren't, it must be one of the other cards.

Now, here's where we start getting tricky. In the large model of Turbo C, and any other C compiler for the PC, we can create a pointer which points anywhere in memory. The function for doing this is MK_FP, for "make far pointer". This bit of code will always point to the beginning of the screen buffer.

```
char *p;
int s_segment;

s_segment = ScreenSegment();
p = MK_FP(s_segment,0);
```

If we now say **p = 'A'*, the very first character in the upper left corner of the screen will become the letter A. This is the location specified by the screen segment and an offset of zero, that is, the very first byte in the segment which defines the screen memory.

On the PC's screen, the odd numbered bytes in memory hold the characters. The even numbered bytes hold the attributes for those characters, which define what colours they are, or whether they're flashing, inverse or underlined on a Herc card.

This will draw a line of the letter A across the top of the screen. It assumes that the previous stuff has all been done.

```
int i;

for(i=0;i+=2) p[i] = 'A';
```


There are 160 bytes in an 80-line screen, and we want to address every odd one. This code will make all the A's in the last line flash in inverse text.

```
for(i=0;i<160;i+=2) p[i+1]=0xf0;
```

The attribute 0xf0 is black text flashing on a white background, quite remarkably hard on the eyes, actually.

Finally, this function will print a string *s* at the location (*x,y*) on the screen using this rather tricky screen interface.

```
printxy(s,x,y)
char *s;
int x,y;
{
    char *p;
    kint offset;

    offset += (160 * y) + (2 * x);
    p = MK_FP(ScreenSegment(), offset);

    while(*s) {
        *p++ = *s++;
        *p++ = 0x07;
    }
}
```

To use this function we would do this:
printxy(10,20,"There once was a hermit named Dave");

This call would print the string ten characters in from the left on line 20.

There are a lot of holes in this function, of course. First off, if you have a colour card in your computer, you'll find that executing this creates a blast of snow on your screen for an instant. This is because the colour card is a bit dim witted, and it clashes with the processor if data is jammed into its buffer at the wrong times. In order to avoid this, we would have to write a fairly complex routine in assembly language which reads some of the registers of the card's controller chip and waited until it was just the right moment to access the buffer. Colour cards being rather antediluvian, it hardly seems worth the effort.

More fundamental problems with this function include its inability to do any screen control at all. It cannot respond properly to carriage returns, line feeds, tabs and so on. You might want to try adding these features to it once you understand what it's up to.

Regularly Scheduled Program

It might well be argued that the subjects
E&TT July 1989

Figure 1: A portion of the screen showing the last line in inverse text.

T	h	e	r	e			n	c	e

How the character byte and the attribute byte would look like in memory.

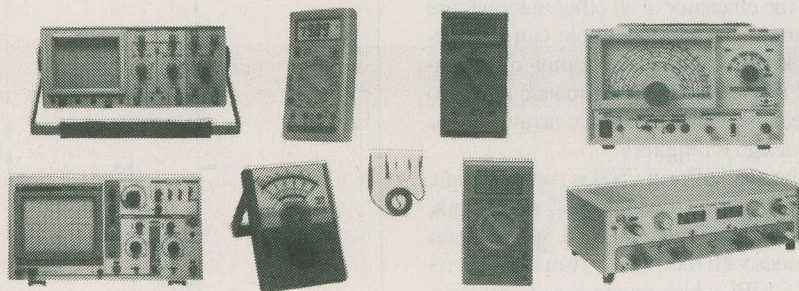
we've looked at this month are a bit advanced, and might well have been better dealt with later on. In theory this is true... in reality, you invariably have to get at the guts of your PC sooner or later. Once you get started, you'll find yourself exploring all manner of dirty tricks. There are those programmers who are of the opinion that

the PC *itself* is a dirty trick, something which IBM created in retaliation for one of those long forgotten antitrust suits which were always snapping at its corporate heels.

In this light it seems somehow appropriate that a few dirty tricks should live on in every program that runs on it. ■

EKI : ELENCO : GOLDSTAR : VIZ : METEX : PEGASUS : EMCO : EICO

TEST INSTRUMENTS AND EDUCATIONAL KITS



New Test Equipment and Electronic Kit catalogue available
 through your Electronic Distributor, or contact:



COWAN DIVISION

R.P. ELECTRONIC COMPONENTS LTD.

2113 WEST 4TH AVENUE
 VANCOUVER, B.C. CANADA V6K 1N7
 TEL: (604) 738-2944 FAX: (604) 738-3002

The AudioPrism Indoor FM Antenna

A novel approach to the problem of indoor antennas.

TIMOTHY PALMER-BENSON

There are few short cuts in designing an FM antenna. Its elements must be tuned to receive the FM broadcast band of 88MHz to 108MHz. The best antenna is a multi-element, half wavelength array mounted as high as possible and capable of receiving signals from only one direction. Such horizontal antennas, like their TV counterparts (that often incorporate FM tuned elements) require a rotor so one can point the antenna directly at the station. As we all know, such installations are expensive, cumbersome and sometimes impractical. Urban dwellers often need something more useful.

The bi-directional, single half wavelength dipole is the most common alternative for indoor use. This ubiquitous piece of 300-ohm twin lead, cut and molded into a "T" is found packed with virtually every receiver. It is the industry standard against which the efficiency of all other antennas are measured. The indoor dipole can give acceptable results but it is not omnidirectional and if one is after performance closer to the ideal of the multi-element array, a more exotic design is required.

The AudioPrism 7500 is such a design. It is an omnidirectional, half wavelength, passive, indoor antenna. The specification that comes with the AudioPrism says that its gain is 5.1dBi, which means it can draw in a signal with three times more power than that of the home dipole. Its Voltage Standing Wave Ratio (VSWR) is less than 1.9 to 1 from 88MHz to 108MHz. This is the ratio of the voltage delivered by the antenna to the receiver as compared to the reflected voltage returned back toward the antenna due to impedance mismatch. Perfect VSWR would be 1:1. Good outside antennas usually have a VSWR of 1:5 or less, meaning that there is a signal loss produced by an im-

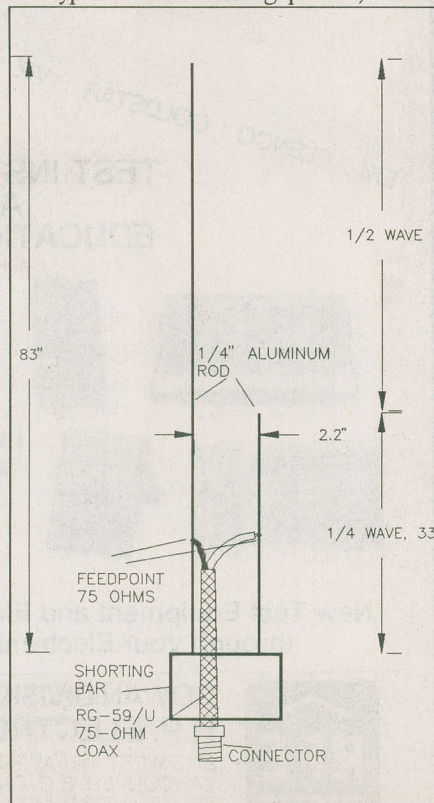
pedance mismatch. Loss of signal usually becomes worse at the frequency extremes.

As a piece of furniture, I find the AudioPrism somewhat astonishing, which is probably why it came to my attention while strolling the aisles in the winter CES in Las Vegas. The outside of the antenna consists of a cylinder tube 89.5 inches high with a diameter of four inches. The tube is made out of 1/4 inch thick hardboard, similar to the type used for mailing posters, and is

covered with a beige coarse weave fabric. A 75-ohm "F" type coaxial connector protrudes from one end and fits into a hole in a solid 13-inch diameter wood base that has a thin sheet of aluminum-covered paper stapled to its underside. The tube is secured to the wood base with two machine screws so that a ground plane is formed from the physical connection of the aluminum sheet in the base and the grounded part of the antenna element inside the tube.

As can be seen in the accompanying diagram, the inside element is shaped like the letter "J" which is why the configuration is called a J-Pole Shunt Fed, half-wavelength antenna with ground plane. Both elements consist of solid 1/4 inch diameter aluminum rods. The ground side is 85 1/2 inches long while the quarter-wave rod is 33 inches. The two rods sit 2.2 inches apart on a shorting bar.

Approximately seven inches up from the base of the shorting bar — at the antenna's resonance point — a 75 ohm cable is attached with its outside shield connected to the ground side. The inside conductor is connected to the other leg. A simple choke (using three turns of the coax) is employed before the cable makes its connection with the 75 ohm "F" fitting on the bottom. Even though a ground plane is not necessary for this configuration, a spokesman for AudioPrism says that it was installed to avoid interaction between the antenna and the 75 ohm antenna lead-in that must exit the base of the antenna at 90 degrees. The company says customers concerned that interaction still exists can avoid any reactance in the coax by installing a broadband RF choke about a 1/4 wavelength away (about 20 inches away) from the base of the antenna. The choke is available free from AudioPrism.



Inside the AudioPrism antenna's hardboard tube are two aluminum rods cut to multiples of a quarter-wavelength.

I tested the AudioPrism using a Magnum Dynalab FT-101 tuner. This is considered one of the best tuners on the market. Among other things, this Canadian-made unit has an easy to read signal strength meter and a meter that indicates multipath conditions. Perhaps of more importance than this is the fact that the FT-101, unlike less professional units, is carefully constructed to provide the same sensitivity at either end of the FM band as well as in the middle of it. I was able to prove this by setting my 1000A Sound Tech Alignment Generator to feed the same strength of RF signal into the antenna input of the FT-101 at 88 and 108MHz and then noting the position of the signal strength meter. The meter read the same in both instances.

Having established this to my satisfaction, I carefully graded the meter on the FT-101 so that I could directly read signal strength in dbf units, the customary way of presenting antenna gain measurements. What you see in the accompanying table (bar graph) is a list of 14 frequencies. Each frequency represents a station that can be received in the Montreal area. The weaker station are in Burlington, Vermont.

As can be seen, the AudioPrism consistently shows more sensitivity than the indoor dipole at the two ends of the FM dial. The first station at 87.8MHz was received with 5dB more gain than the indoor dipole gave. This is significant, because at 42dbf even the Magnum Dynalab is on the point of muting and dropping out of stereo. With the extra 5dB of gain going into its antenna input, it

had no difficulty reproducing this station with clarity. The most significant difference between the two antennas occurs at the other end of the dial at 107.3MHz where the AudioPrism produced a signal strength of an astounding 83dbf over the 47dbf reading obtained with the dipole. I am inclined to discount this reading because it may have been caused by the different polar responses of the two antennas.

While the results in midband are inconclusive, the figures show that the AudioPrism is a worthwhile investment for anyone who cannot use an outside antenna and wants a passive, omni-directional unit. The antenna will be distributed by May Audio in Montreal, with the Canadian price expected to be just over \$200.00. The manufacturer is AudioPrism, P.O. Box 1124, Issaquah, WA 98027. Tel: (206) 392-0399. ■

CLASSIFIEDS

Where Buyers Find Sellers

COMPUTER PARTS SALE: For XT/AT/386 Compatibles. IC-Tester Adapters, Fax, Logic Analyzer Cards. Discount Prices, Catalogue. Write HES, P.O. Box 2752 Stn.-B, Kitchener, Ontario N2H 6N3

New Canadian Mail-order service of quality electronic components. No minimum order, very competitive prices, special order services. Most orders shipped same day! Send \$2.00 today for catalogue (credit towards first purchase) M.U.C. Sales, P.O. Box 994, Kingston, Ontario K7L 4X8.

For Advertising Information Call:
(416) 445-5600 Or Fax:
416-445-8149

THE ULTIMATE IN AUDIO MEASUREMENT

Audio
precision

SYSTEM ONE-A

Monaural / Stereo



- NOW AVAILABLE WITH RS232 SERIAL PORT AND IEEE-488 INTERFACE • Performs the following audio tests: frequency response, total harmonic distortion plus noise, intermodulation distortion, s/n ratio, wow & flutter, noise, gain, loss, crosstalk, phase • Tests can be performed to SMPTE, DIN, CCIR, EIA, IHF and NAB standards • Tests can be performed on all audio components, satellite and microwave paths, etc.
- Test procedures and results can be displayed on a CRT, stored on a disc, or hard-copied on a printer for examination or future use. • System is accessed from computer keyboard —no switches, dials or meters required • Computer experience not needed to operate • Go/no-go standards easily set up.

FOR PROMPT
SERVICE
CALL JOHN
OR PATRICIA
COLLECT



90 NOLAN COURT, UNIT 7
MARKHAM, ONT.
L3R 4L9
(416) 475-8494
FAX: (416) 475-0955

AutoCAD for Electronics Part 3

Tips and techniques for high-speed schematic drawing.

BILL MARKWICK

Last month we looked at custom menus and their macros, perhaps the easiest way to make AutoCAD fast and convenient. As we mentioned, AutoCAD straight from the box tries to be everything to everybody; it's probably the most flexible program around, with every possible parameter under your control. However, this also means that you'll be typing your brains out selecting default after default, and often you'll probably find yourself lost down a long winding path because the operation of some commands depends on how you select points, whether you use a window, etc.

A quick recap: many of AutoCAD's variables are determined by a master drawing called ACAD.DWG. Load this as an existing drawing, change the variables to suit yourself and then save it. Use the Reference

Manual to check out ACAD.MNU, the menu that comes with it, and see how it's laid out; write a screen menu (the one that appears in the right-hand sidebar) to call up your most-often used commands the way you like them. Investigate the pulldown menus (Release 9 or 10 only) and you can create hundreds of commands just the way you like them. If you have a digitizing tablet, write your own tablet menu. Using the three types of menus, you can almost retire the keyboard, and AutoCAD will zip along as fast as you can go (usually).

The June issue contains detailed explanations of how to write menus, with the single most useful function being the macro. Each command title on your menu can actually call up a sequence of further commands, letting you do a complex bit of draw-

ing with no more than a few mouse clicks.

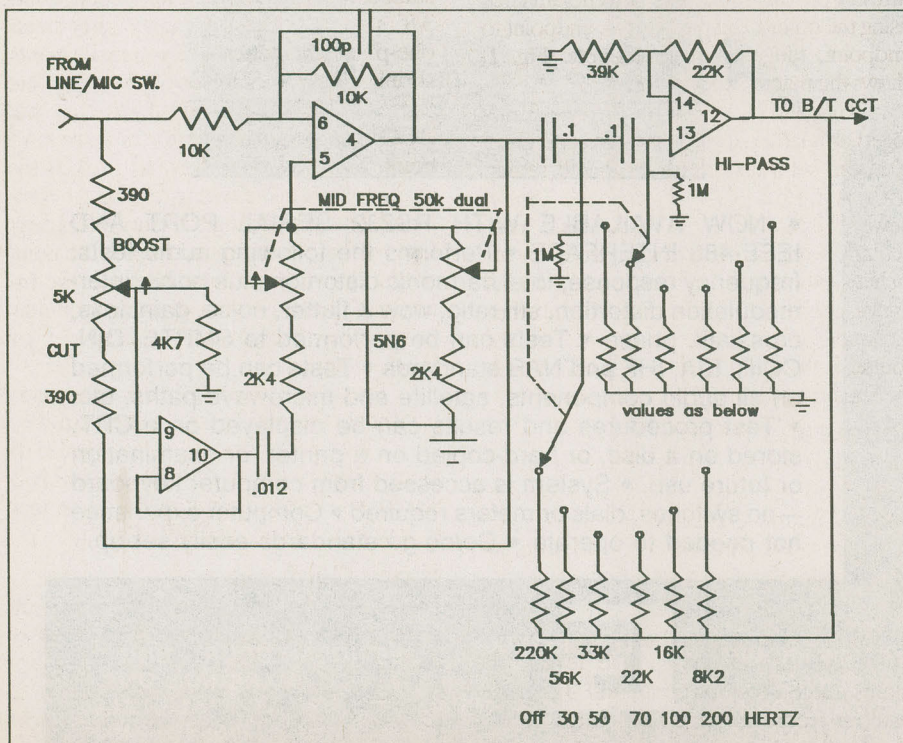
The PGP File

I assume that you've tinkered with your custom menus and you're ready to go. But first, I also assume that you've ended up a bit frustrated because editing your menu means exiting AutoCAD, loading your word processor, reloading AutoCAD to try it out and so on. You can speed this up considerably with AutoCAD's ACAD.PGP file, a utility that lets you call up other programs right in the middle of AutoCAD. When you exit your new program, you're back in the AutoCAD drawing editor. Much faster. Here's my PGP file:

```
DEL,DEL,27000,File to delete: ,0
DIR,DIR,27000,File specification: ,0
EDIT,WS,200000,0
SH,27000,*DOS Command: ,0
SHELL,127000,*DOS Command: ,0
TYPE,TYPE,27000,File to list: ,0
```

You can get the syntax from the reference manual, but in general it works like this, using the EDIT line as an example: the first word (EDIT) is what you would type at the AutoCAD command prompt to start your word processor. The next word (WS) is the command that AutoCAD will pass to DOS (to start WordStar), and the assumption is that the word processor is in your ACAD directory or path. The number 200000 is the amount of RAM reserved for your processor. The two following commas mean that no prompt is issued (unlike DEL, for instance, which will print out "File to delete:"). The last number is a return code, with zero meaning that the screen stays in the text mode rather than returning to the graphics screen (a "4" returns to graphics).

Setting up your own PGP file means that you can scoot in and out of DOS, or your word processor, or whatever, all without the need to reload your AutoCAD drawing.



Starting Off

Let's start by drawing a schematic (*whew! At last!*) and examining the bottlenecks that crop up along the way.

One time-consuming operation is hooking one line onto the end of another, or attaching a block at an exact point. The monitor may show a perfect connection, but under some zoom conditions you can see that it's not really connected at all. Another is the problem of getting lines exactly horizontal or vertical; when printed out they often lean, though they look good on the monitor.

And of course, the frustration of trying to fix your mistakes — you often want to scrap it and start over because you're just making the muddle worse.

And while all this is going on, AutoCAD is taking *so-o-o* long to regenerate...

Step 1: Layers

Before starting to draw, you should have a minimum number of layers. AutoCAD is actually fairly fast at regeneration — if you're drawing lines. It's text, hatching and filling in solids that gives it that slow-motion look, and if these are on their own layers you can shut them off when they aren't needed (with Freeze Layer).

Call up ACAD.DWG and create Text and Hatch layers; while you're at it, type SOLID OFF so that solids will be drawn as wireframe rather than filled in. All new drawings will then have these parameters.

Step 2: Osnap

Osnap, or Object Snap, will eliminate all that jiggling and wiggling with the mouse, trying to get things to hook up. There are two ways to do it: one is to put AutoCAD into permanent object snap by typing OSNAP and then the modes you prefer, such as Endpoint, Midpoint, etc. This works well under some conditions and gets in the way in others. Another method, and the one that I like because it's easily called from menus, is one-time Osnap. This is invoked by typing or selecting Endpoint, Midpoint, etc., whenever AutoCAD requires a point.

Here's a macro I use all the time that will demonstrate what I mean. Most schematics have a lot of components hooked up to a supply or ground rail, and it can take a lot of time to accurately connect all those vertical lines.

```
[End,Perp] ^ CLINE;ENDP;\PERP;\;
```

The square brackets denote the com-

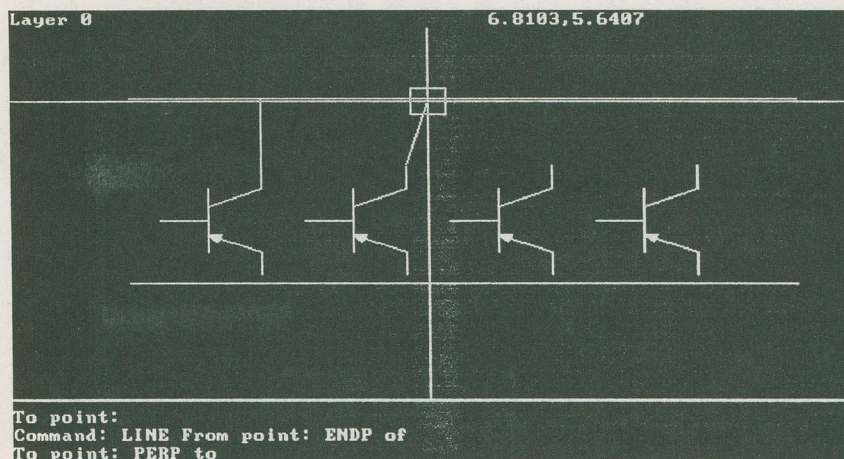


Fig. 1. Illustrating the ENDP,PERP macro described in the text. You only need to get the cursor near the transistor collector and the supply rail — AutoCAD will then draw a perfectly perpendicular line. No zooming or mouse-jiggling needed.

mand name. The Ctrl-C cancels any command in progress, the semicolons represent Returns, and the left slash waits for you to pick a point or object. To use this, say from a transistor collector to a supply rail, select the command and AutoCAD will ask "Endpoint of?". Select the transistor collector and AutoCAD will ask "Perpendicular to?". Click on the supply rail and there you are, a perfectly vertical, perfectly terminated line — no editing required, and you don't even have to hit the points exactly; Osnap captures within 10 pixels (the default Aperture). You can make lots of other macros using the other Osnap modes — endpoint to endpoint, tangents to circles, etc. Fig. 1. shows the macro in operation.

Another method of fitting things together neatly is to use the Snap and Grid. You can set the size and the on/off setting with ACAD.DWG. There are times, however, when Snap isn't that useful, particularly when loading blocks. You can attach a symbol for an op amp to a line, for instance, only to find out that none of the other terminals match anything. The cure, of course, is to design your symbol library with the Snap mode in mind; more on that later.

Zooms and Regen

As noted, Freeze any layers you don't need. You may have a tendency to use Zoom Window to zoom in and Zoom All to see the whole drawing. This will result in a Regen almost every time.

Instead, use Zoom Window to move in closer, and Zoom Previous to get back; AutoCAD stores up to five levels of zooms in the Previous command. This will result in Redraws, which are much faster than Regens.

Another good one is View Save and Restore. This lets you bounce around the drawing at Redraw speeds.

Blocks

One of the cardinal rules of CAD is *never draw anything twice*. To avoid doing this, most people have a library of drawing files containing components that they use all the time. There are two ways to make one of these library drawings. One is to start a new drawing and create the component in the size that you'll be using most; for instance, I made the transistor symbol about 3/8" square because I make fairly small, one-page schematics — if you make giants, shrink the symbol accordingly (note: use the SCALE command to do this, not ZOOM; zooming only affects your viewpoint, not the actual drawing size). If the size turns out to be wrong, the Insert command lets you change it during loading. Use the BASE command to pick the point on the drawing that later becomes the Insertion Point. Save your drawing (you may want to use a subdirectory to keep all your blocks organized).

The second way is to create a new component in the middle of another drawing. AutoCAD allows you to select the component and define it as a Block (which is stored only in the drawing itself — to write it to your block library, use WBLOCK).

Block Confusion

Blocks are an enormous timesaver, but sometimes they'll drive you nuts. They're like that.

First, when you work with them in a drawing, AutoCAD treats them as a single object and won't let you Trim or Erase block

AutoCAD for Electronics, Part 3

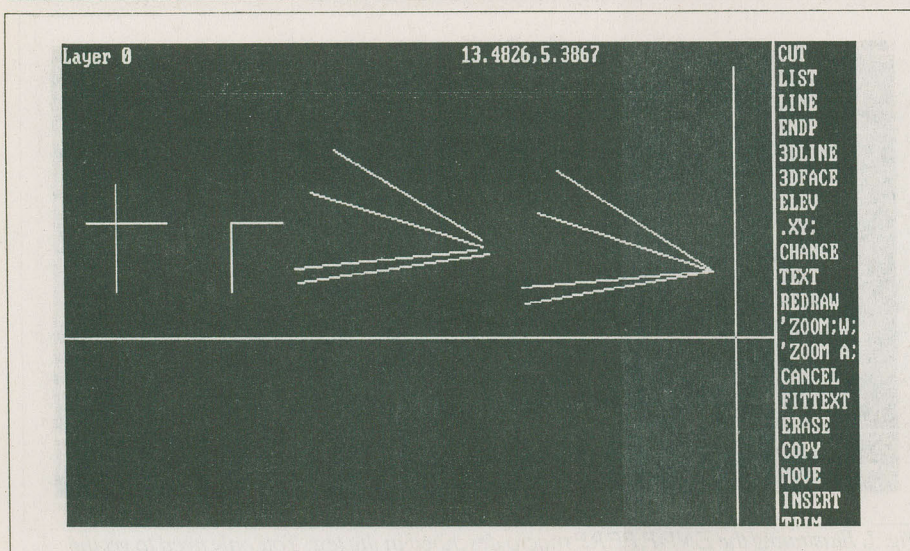


Fig. 2. The lines at the left have failed to intersect properly because they're too long. The fastest fix is to use CHAMFER or FILLET with zero settings — the lines will instantly be trimmed to a perfect corner. The converging lines, second right, fail to meet when you zoom in. Select CHANGE, type in a new point, and AutoCAD redraws each line until they meet exactly.

parts. You can return them to a group of separate objects with the EXPLODE command and then edit away. Or, during loading, you can precede the block's filename with an asterisk (*). This loads the block as a group of separate objects.

Second, blocks are with the drawing forever, even if you erase them. Getting rid of dead blocks is bizarre: you have to exit, reload the drawing and then type PURGE. You'll be asked if you want to purge various layers and blocks. If you type anything else before Purge, anything, AutoCAD says "Purge can't be used right now."

Third, blocks in your library can interact. Suppose you have a diode block, and you use it to make another block called LED. If you then load the diode into a drawing and redefine it, the LED block will reflect the same changes when it's loaded in. Try creating a new block rather than redefining.

Drawings of any complexity can be loaded as blocks and scaled to any size. For instance, I loaded all my electronic component blocks into one drawing called Symbols. I then printed it out and stuck it on the wall for reference.

Last month we looked at a pulldown menu for Release 9 or 10 that lets you call blocks up on the screen icon-style, eliminating any typing. You can get 16 blocks on the menu comfortably, and you can have as many icon menus as you like, making block insertion practically painless.

Block Troubleshooting

Wrong Size: call up the block drawing and use SCALE, assuming the change should

be permanent. For changes in a drawing (ones that don't affect the block file), use SCALE within the current drawing.

Wrong Insertion Point: load the block drawing and use BASE.

Facing Wrong Way: to turn your block mirror-image, add the following version of the Mirror command to your menu:

MIRROR;\;\Y;

Pick a vertical line around which the block should rotate, and that's it.

Remember that blocks are stored in your drawing so that drawing files can be transportable; otherwise you'd have to copy your block library onto every disk. Suppose you load a symbol for multiple insertions into your drawing, but find that it isn't quite suitable. Use Explode and various edit commands to change it, but don't use the Block command to redefine it unless you're really sure about this. If you generate different blocks with the same name (one in your drawing and one in the library), you're heading for future confusion for sure. Rename it, or use Multiple Copy for any further insertions within the drawing.

Editing

I think learning how to edit mistakes was the most painful thing to do in AutoCAD. It seemed to take ages before I could do it with any speed, but now I've accumulated a whole box full of tips and tricks (somebody once said that the difference between a veteran and a beginner is that the veteran can fix his mistakes faster). AutoCAD has a wealth of editing commands for fixing, adding and changing. Here's a rundown on

some commands, some problems, and some fixes.

Poor Connections: You've probably zoomed into a section of your drawing only to find lines that don't meet or symbols hanging in space instead of being attached. You can prevent this from happening by using the Osnap methods previously described, but for fixing, try the Move command with Osnap: MOVE, Endp, Endp will reconnect a line properly from one point to another or reconnect a symbol where it should be (you can also use all the Osnap features: Perp, Mid, Cent, and so on).

Tilts: lines that appear horizontal or vertical may have a tilt to them when magnified or printed. The Change command will let you replace one of the endpoints (or other point) to straighten things out. It will also work with a lot of lines at once, as shown in Fig. 2. Change has so many features, I'll give it its own section, next.

Change: If you select an object or objects and click the mouse, Change will replace points. If you press Return, a little menu appears, letting you change Color, Elevation, Layer, Linetype and Thickness. It beats erasing and replacing.

Change has special features for certain types of objects. If you select a circle and type a Return, you can change its radius. If you select text, yet another submenu appears, letting you change all the characteristics of the text. Sure beats retyping just to change the text height. See Section 5.3 in the Reference Manual for even more Change functions.

Wrong Lengths: Sometimes lines will be too long or too short because of editing changes or because they were drawn imprecisely. The TRIM and EXTEND will cut and lengthen objects, respectively. Note that you can't edit a Block unless you use the Explode command on it first. The BREAK command is like Trim, but works on a single line. It's a funky one, Break is, because its operation depends on where you pick points. For this reason, I prefer Trim if I can use it.

Here's a macro that lets you cut a line to any length. First, it lets you draw a line through the point where you want the existing line cut off. Pick the part you want trimmed, and the macro will do this and then erase the temporary line it drew.

[CUT]LINE;\;\TRIM;L;\;ERASE;L;

Poor Intersections: Sometimes lines that seem to be making a perfect angle are actually crossing each other when you zoom in. Rather than using Trim or Break to fix this, try CHAMFER or FILLET with their values set to zero. They'll instantly snip off

ORION ELECTRONICS SUPPLIES INC.

IMPORTERS & DISTRIBUTORS INDUSTRIAL — COMMERCIAL — EDUCATIONAL SALES & SERVICE

ORION SYSTEM 88

4.77/10 MHZ MOTHER BOARD. 256K MEMORY
360K DISK DRIVE AND ADAPTER. MONO-
CHROME OR COLOUR VIDEO. ADAPTER.
SERIAL. PARALLEL. GAME. CLOCK PORT.
150W POWER SUPPLY. AT KEYBOARD.

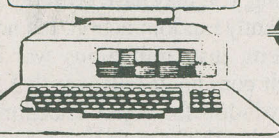
\$599

ORION SYSTEM 386

1MB MEMORY. 16/20 MHZ MOTHER BOARD.
1.2MB DISK DRIVE. 16 BIT DISK CONTROLL
MONOCHROME OR COLOUR VIDEO ADAPTER.
SERIAL. PARALLEL. GAME. CLOCK PORT.
200W POWER SUPPLY. AT KEYBOARD.

\$2495

ORION
COMPUTER
SYSTEMS



CALL FOR THE LOWEST CUSTOM QUOTES

ORION SYSTEM 286

6/10/12.5 MHZ MB. 512K MEMORY
1.2MB DISK DRIVE. 16 BIT DISK CONTROLL
MONOCHROME OR COLOUR VIDEO ADAPTER.
SERIAL. PARALLEL. GAME. CLOCK PORT.
200W POWER SUPPLY. AT KEYBOARD.

\$1295

ORION PORTABLE SYSTEMS

	88 256K	286 512K	386 1MEG
9" AMBER DUAL CRT	1295.00	1895.00	2995.00
LCD 600x400 SCRN	1645.00	2245.00	3345.00
PLASMA 600x400 S	2395.00	2995.00	4095.00
9" EGA MONITOR	2795.00	3395.00	4495.00

HARDWARE, SOFTWARE & PERIPHERALS AT DISCOUNT PRICES

SEAGATE HARD DISK SYSTEM

20MB (DRIVE CONTROLLER/CABLE)	399.95
30MB (DRIVE CONTROLLER/CABLE)	429.95
WE CARRY THE MOST EXTENSIVE LINE OF REG. OR HIGH DENSITY DRIVES & CONTROLLERS. (CALL FOR A COMPLETE PRICE LIST)	

FLOPPY DISK DRIVE

PANASONIC OR EPSON (YOUR CHOICE)	
5 1/4" 360K DS/DD	119.95
5 1/4" 1.2M HIGH DENSITY	139.95
3 1/2" 720K DS/DD	125.95
3 1/2" 1.44M HIGH DENSITY	145.95
HARDWARE & MOUNTING BRACKET FROM 3 1/2" - 5 1/4"	9.95

HARD DISK & FLOPPY DISK CONTROLLER

XT FLOPPY CONTROLLER	39.95
XT HIGH DENSITY CONTROLLER	74.95
XT HARD DRIVE CONTROLLER	45.95
XT RLL HARD DISK CONTROLLER	99.95
AT HARD DISK/FLOPPY CONTROLLER	189.95
AT RLL HARD DISK CONTROLLER	299.95
AT HARD DISK CONTROLLER	169.95
60M TAPE BACKUP SYSTEM FROM	895.00

MODEMS/FAX

1200 HAYES COMP. INTERNAL	99.95
1200 HAYES COMP. EXTERNAL	129.95
2400 HAYES COMP. INTERNAL	189.95
2400 HAYES COMP. EXTERNAL	199.95
FAX CARD 4800 WITH SOFTWARE	649.00
FAX CARD 9600 WITH SOFTWARE	995.00
PANAFAX UP-150 WITH PHONE	1695.00
PANAFAX UP-250 WITH PHONE	2495.00

SCANNERS

HANDY SCANNER 2.5"	299.95
HANDY SCANNER 4.18"	375.95
LOGITECH SCANNER 4.18"	399.95
CAT IMAGE SCANNER (FOR PRINTER)	299.95
CHINON DESK SCANNER	895.95
SHAPE DESK TOP	1295.00

MICE

LOGITECH SERIAL	99.95
LOGITECH BUS	119.95
LOGITECH HIRES	149.95
DEXXA 2 BUTTON	69.95
MOUSE PAD	7.95
IBM COMPATIBLE JOY STICKS	29.95
GRAVIS CANADIAN MADE JOY STICK	54.95

DIGITIZERS

KEMAN CT1170 1000 LINE/INCH	495.00
TITAN KT2000 400 LINE/INCH	550.00
TITAN KT3000 1000 LINE/INCH	595.00

POWER SUPPLIES

1500W ULCSA	99.95
2000W ULCSA	139.95
2000W ULCSA FOR TOWER CASE	189.95
AT STYLE CASE FLIP FOR	
- XT OR BABY AT MOTHER BOARD	69.95
AT FULL SIZE CASE WITH HARDWARE	109.95
AT TOWER CASE	225.95

PORTABLE FOR AT OR XT WITH POWER SUPPLY -
9" DUAL AMBER MONITOR, KEYBOARD 895.00
LCD PORTABLE WITH POWER SUPPLY KEYBOARD -
600x400 LCD SCREEN 1150.00
SAME AS ABOVE BUT PLASMA DISPLAY 1795.00

KEYBOARDS

XT/AT 5060 STANDARD 84 KEY KEYBOARD	69.95
XT/AT ENHANCED 101 KEY KEYBOARD	89.95

IBM COMPATIBLE BOARD

MOTHER BOARD	
4.77/10MEG XT OK	129.95
6/8/12MEG AT 286 OK	395.00
10/12MEG AT 286 4MEG EMS OK	475.00
16/20 286 "NEAT"	895.00
16/20 386 OK	1250.00

VIDEO ADAPTER

MGA HERCULES COMP. W/ PRINTER PORT	69.95
CGA COLOR GRAPHIC VIDEO ADAPTER	59.95
EGA 640x350 256K	229.00
SUPER EGA 640x480 256K	299.00
ATI GRAPHIC SOLUTION	199.00
ATI WONDER CARD	359.00
ATI VIP MGA/CGA/EGA/VIDEO	459.00
ATI WONDER + VGA AUTO	549.95
G7 MGA/CGA AUTO SWITCH	149.00

IO CARDS

XT PARALLEL PRINTER PORT	29.95
XT RS232 SERIAL PORT	34.95
XT I/O + 2 (S/P/C/G)	79.95
XT MULTI I/O (S/P/C/G/DISK CONTR)	89.95
XT GAME PORT (TWO PORT)	29.95
AT GAME PORT	49.95
TIME CARD WITH BATTERY BACK UP	49.95
AT I/O SERIAL PARALLEL	69.95
AT I/O SERIAL PARALLEL GAME	79.95

MEMORY CARDS

XT 576 RAM CARD OK	54.95
XT 2 MEG EMS 3.1 3.2 4 OK	129.00
AT 2 MEG EMS OK	149.00
2.5 MEG EXPANSION CARD	109.00

APPLE COMPATIBLE COMPUTER

BOARDS	
III LASER 128K II + IIe/IIc COMP	649.00
LASER DISK DRIVE "C" COMPATIBLE	199.95
LASER DISK DRIVE II + COMPATIBLE	199.95
80 COLUMN CARD AUTO SWITCH	99.95
Z80 CARD FOR CPM	69.95
SERIAL PRINTER CARD MODEM PRINTER	99.95
NICE PARALLEL PRINTER CARD	99.95
16K RAM (LANGUAGE CARD)	69.95
SPEECH CARD	75.00
COLOR MODULATOR KIT	19.95
POWER SUPPLY	119.95
DISK CONTROLLER CARD	69.95

SPECIALTY INDUSTRIAL BOARDS FOR IBM COMPUTERS

SA-1206D ANALOG INPUT	495.00
SD-1203 ANALOG OUTPUT BOARD	535.00
SC-1602 A/D-D/A CARD	495.00
SI-3232 INDUSTRIAL CONTROL MODULE	549.95
SI-7210C IEEE 488 CARD (GP/IB)	349.95
SI-8255 8255 I/O CARD	149.95
SI-8250 RS422 CARD ZACTIVE PORT	119.95
SI-5124 FROM WRITER FOR 4EPROM	299.95

WE CARRY A LARGE SELECTION OF EMPROM
WRITER, UNIVERSAL PROGRAMMER, IC TESTER
PAL PROM PROGRAMMER (CALL FOR INFO.)
AB SWITCH BOXES SERIAL/PARALLEL AUTO - OR
MANUAL WITH/OUT BUFFER FROM 39.95
GENDER CHANGER DB9/15/25 F/FI MM. CON-
VERTERS, BOOSTERS, MINISTESTERS

LOCAL AREA NETWORK SYSTEM

UPS 110/210 ARCNET LANCARD	229.00
UPS 1000 ETHERNET LANCARD	349.00
UPS 400 4PORT ACTIVE HUB CARD	229.00
UPS 404 4PORT PASSIVE HUB CARD	59.95
UPS 808 8PORT ACTIVE HUB CARD	495.00

CALL FOR FULL INFORMATION

HIRES MONITORS

GOLDSTAR	
4215 RGB	399.95
4095 EGA	499.95
1430 VGA	599.95
2115 12" AMBER SWIVEL BASE	139.95
2025 12" AMBER COMPOSITE	129.95
PACKARD BELL AMBER SWIVEL BASE	129.95

TTX MONITORS

1201A 12" COMP. AMBER MONOCHR	129.95
1400F/A 14" TTL AMBER FLAT SCREEN	179.95
1452F/M 14" VGA AN W/HT FL. SCREEN	199.95
2410 14" RGB 43mm POL. TLT/ISW	399.00
2410AG 14" RGB 43mm A GL. TLT/ISW	445.00
2411 14" RGB 39mm POL. TLT/ISW	475.00
2411AG 14" RGB 39mm A GL. TLT/ISW	499.00
2412 14" EGA 39mm A GL. TLT/ISW	575.00
2422 14" EGA 31mm A GL. TLT/ISW	599.00
1435 14" MULTI SYNC	850.00
1310 14" ELECTROHOME M. SYNC	1095.00
1910 19" ELECTROHOME M. SYNC	3250.00

DATATRAIN MONITORS: COLOUR

DC2005 14" 41mm DOT P. RGB T/S	449.95
DC2055 14" 52mm DOT P. RGB T/S	349.95
DC3535 14" 31mm D.P. EGA/CGA/T/S	549.95
DC355 14" DOT PITCH 41mm EGA/CGA	479.95
DC505 14" DOT PITCH 41mm VGA	499.00
DC600 14" M RES VGADIG. D.P. 31mm	679.95

DATATRAIN MONITORS: MONOCHROME

V240A 12" 2" AMBER COMPOSITE	139.95
V242 12" 2" TTL AMBER OR GREEN	134.95
V252 12" M RES MONO AMS/GRN	149.95
V262A 12" FLAT SCREEN TTL AMBER	159.00
V272 14" DUAL FREQ. AMBER/WHIT	189.95
V282 14" D. FREQ. FLT SCRN AWH	199.95
V502 12" ANLG VGA/MCGA MONO WH	199.95

PRINTERS

ROLAND PRINTERS	
RAVEN PR-9101 9 PIN AUTO	192 CPS 299.95
RAVEN PR-2417 24 PIN AUTO	192 CPS 549.95
RAVEN PR-9104 9 PIN AUTO	240 CPS 375.00
PR1012 1440CPS DOT MATRIX	249.95
PR1112 1920CPS DOT MATRIX	299.95
PR1212A 219CPS DOT MATRIX	475.95
PR1250 2880CPS DOT MATRIX	549.95
PR1215 2160CPS WIDE CARRIAGE	699.95
PR1550 2880CPS WIDE CARRIAGE	799.95
PR2450 240CPS WIDE CARRIAGE	999.00
PR2017 17CPS DAISY WHEEL	449.95

EPSON 9 PIN DOT MATRIX PRINTERS

LX-800 180/150CPS DRFT/30/25 NLO	275.00
EX-1000 250/45CPS DRFT/NLO SL. TP	899.00
EX-800 250/45CPS DRFT/NLO SL. TP	899.00
FX-1050 264/54CPS DINLO 132CL SPK	899.00
FX-850 265/54CPS DINLO SMARTPARK	650.00
FX-86E 200/40CPS DINLO 80 CLMN	549.00
24-PIN LETTER QUALITY DOT MATRIX PRINTERS	
LQ-1050 264/220/88/73CPS	1095.00
LQ-2500 270/90CPS DRAFT/NLO	1499.00
LQ-500 180/60CPS DRAFT/NLO ESC/P	575.00
LQ-850 264/220/88/73CPS	895.00
DX-10 10CPS EPSON 10CPS DAISY WHEEL	349.00
SO-2500 540/180CPS DRAFT/NLO	1495.00
STAR 24 NOZZLE INK JET 132 COL	

STAR PRINTERS

NX-1000 144CPS	289.00
NX-1000C 144CPS	289.00
NX-1000C 144CPS 7COLOUR	399.00
NX-1000 144CPS 7COLOUR	399.00
NX-15 120CPS	549.00
NR-10 240CPS	599.00
NR-15 240CPS	799.00
NX-2400 170CPS	549.00
NB24-10 216CPS	775.00
NB24-15 216CPS	995.00
LASER PRINTER	2995.00

ORION DISKETTES

100% ERROR FREE & LIFETIME WARRANTY

ORION BRAND 5 1/4" DISKETTES

DD2D 360K DS/DD	\$ 8.95
DD2HD 1.2M DS/HD	\$17.50
FOR COLOUR ADD	\$ 3.00

ORION BRAND 3 1/2" DISKETTES

OF2DD 1M DS/DD	\$19.95
OF2HD 2M DS/HD	\$49.95
FOR COLOUR ADD	\$ 4.00

NO NAME DISKETTES

5 1/4" DS/DD 360K	\$ 4.99
FOR COLOUR ADD	\$ 3.00
3 1/2" 1M	\$14.99
FOR COLOUR ADD	\$ 4.00

FOR QUANTITY DISCOUNTS CALL

KAO®
KAO is for keeps



KAO MD2D 5 1/4" 360K DS/DD	9.95
KAO MD2HD 5 1/4" 1.2M DS/HD	19.95
KAO COLOUR DISKETTES ADD	3.00
KAO MF2DD 3 1/2" 1M DS/DD	22.50
KAO MF2HD 3 1/2" 2M DS/HD	49.95
KAO COLOUR DISKETTES ADD	4.00
KAO DISCARD 3 1/2" IN POUCH	29.95

ROLAND PLOTTERS

DXY-980A B-SIZE ELECTROSTATIC	1995.00
DPX-2200 C-SIZE FLATBED	5750.00
DXP-3000 D-SIZE FLATBED	6995.00
DXY-1100 A/B-SIZE 8 PEN	1349.00
DXY-1200 A/B-SIZE ELECTROSTATIC	1749.00
DXY-1300 A/B-SIZE 1M BUFF STD	2295.00
GRX-300 D-SIZE ROLLERBED	5995.00
GRX-400 E-SIZE ROLLERBED	7995.00

ROLAND PLOTTER PENS

WATER BASE	4/17.50
OIL BASE	4/19.50
CERAMIC BASE	4/34.95
IMAGETEC PLOTTER PENS	
FIBER TIP	4/9.95
ROLLER BALL	4/17.50

PLOTTER PAPER ALL SIZES

UNINTERRUPTIBLE POWER SUPPLIES	
UPS-250 SENDON	499.00
UPS-400 SENDON	599.00
UPS-800 SENDON	1299.00
POWER BAR WITH SURGE PROTECTOR	17.50
DD-100L HOLDS 100pc 5 1/4" WITH LOCK	12.50
DD-140L HOLDS 140pc 5 1/4" WITH LOCK	14.95
DD-80L HOLDS 80pc 3 1/2" WITH LOCK	14.95

ROLAND LAZER PRINTERS

CP 1100 11PSP/MIN	2995
1 MEG MEMORY EXPANSION CARD	599.00

WE CARRY ONE OF THE LARGEST SELECTION OF
RIBBONS FOR ALL TYPES OF PRINTERS. SOFT WARE
FOR IBM, APPLE, COMMODORE, ATARI ETC. BOOKS
FROM MOST PUBLISHERS. CALL FOR A FREE FLYER
& PRICING. COMPUTER CABLES FOR PRINTERS,
MODEM, DISK DRIVES, CUSTOM MADE CABLES,
CONNECTORS, DB SERIES, HEADERS, EDGE CARD
SEMICONDUCTORS, RAM ROM, EPROM, TTL CMOS,
TUBES, CAPACITORS, RESISTORS, FUSES, CRYSTALS,
TRANSISTORS, LAMPS, SWITCHES ETC. TEST
INSTRUMENT, SCORE MULTI-TESTERS, LOGIC PROBES,
ETC. ELECTRONIC KITS, EDUCATION / HOBBYIST
MOVING SIGN ANY SIZE

CALL US FOR YOUR ELECTRONIC NEEDS!

If you find a better price
call us before you buy.

Order desk & technical support open:
9:00 a.m. to 6:00 p.m. Monday-Friday
9:00 a.m. to 5:00 p.m. Saturday

For Service
CALL

1-519-576-9026

Immediate shipment on purchase
orders from qualified institutions
(schools and universities included).

DEALER INQUIRIES INVITED

MOST ORDERS SHIPPED
WITHIN 24 HOURS.

SERVING YOU FOR OVER 15 YEARS

WHY WAIT? CALL ORION ELECTRONICS NOW!

ORDER TOLL FREE!

1-800-265-2658

40 LANCASTER ST., W. KITCHENER, ONT. N2H 4S9
PH: (519) 576-9902 FAX: (519) 576-9028

FOR IMMEDIATE ACTION USE OUR FAX

Credit card charges
are not submitted
until time of
shipment



Circle No. 35 on Reader Service Card

AMAZING SCIENTIFIC & ELECTRONIC PRODUCTS

PLANS—Build Yourself—All Parts Available in Stock

- LC7—BURNING CUTTING CO2 LASER.....\$20.00
- RUB4—PORTABLE LASER RAY PISTOL.....\$20.00
- TC07—3 SEPARATE TESLA COIL PLANS TO 1.5 MEV.....\$20.00
- J0G2—JON RAY GUN.....\$10.00
- GRA1—GRAVITY GENERATOR.....\$10.00
- EML1—ELECTROMAGNET COIL GUN LAUNCHER.....\$8.00

KITS With All Necessary Plans

- MFT3K—FM VOICE TRANSMITTER 3 MILE RANGE.....\$59.50
- VWP7K—TELEPHONE TRANSMITTER 3 MILE RANGE.....\$49.50
- BTC3K—250,000 VOLT 10-14" SPARK TESLA COIL.....\$249.50
- LHC2K—SIMULATED MULTICOLOR LASER.....\$44.50
- BLS1K—100,000 WATT BLASTER DEFENCE DEVICE.....\$69.50
- N1G7—NEGATIVE ION GENERATOR KIT.....\$34.50
- PSP4K—TIME VARIANT SHOCK WAVE PISTOL.....\$59.50
- STA1K—ALL NEW SPACE AGE ACTIVE PLASMA SABER.....\$59.50
- PGSK—PLASMA LIGHTNING GLOBE KIT.....\$49.50
- 505K—SEE IN THE DARK VIEWER KIT.....\$199.50

ASSEMBLED With All Necessary Instructions

- BTC10—50,000 VOLT—WORLD'S SMALLEST TESLA COIL.....\$54.50
- LGU40—1 MW H₂ He VISIBLE RED LASER GUN.....\$249.50
- TAT30—AUTO TELEPHONE RECORDING DEVICE.....\$24.50
- ITM1—100,000 VOLT 20' EFFECTIVE RANGE INTIMIDATOR.....\$99.50
- LST10—SNOOPER PHONE INFINITY TRANSMITTER.....\$169.50
- PG70—INVISIBLE PAIN FELD GENERATOR—MULTIMODE.....\$74.50

• CATALOG CONTAINING DESCRIPTIONS OF ABOVE PLUS HUNDREDS MORE AVAILABLE FOR \$1.00 OR INCLUDED FREE WITH ALL ABOVE ORDERS.

PLEASE INCLUDE \$3.00 PH ON ALL KITS AND PRODUCTS. PLANS ARE POSTAGE PAID. SEND CHECK, MO, VISA, MC IN US FUNDS.

INFORMATION UNLIMITED
P.O. BOX 716, DEPT. ET AMHERST, NH 03031

Circle No. 36 on Reader Service Card

Advertisers' Index

Brunelle Instruments	17
CED Corporation.....	20
Chips and Stuff.....	20
Daetron.....	49
DeVry Inc.	61
Duncan Instruments	62
Exceltronix.....	2, 3
Fluke	63
Glentronix.....	55
Information Unlimited.....	60
International Light.....	20
KB Electronics.....	49
McGraw - Hill.....	45
Multicore Canada Inc.....	19
Ontrak Control Systems.....	20
Orion.....	59
Protel Technology Inc.....	51
R.P. Electronics Components Ltd.	53
Tektronix Canada Inc.	64
Toshiba	4

For Advertising Information
Call (416) 445-5600
Fax: 416-445-8149

AutoCAD for Electronics, Part 3

the offending overhang leaving you with perfect corners. I use Fillet for rounding corners, so I leave Chamfer set to zero at all times for line editing (either one works — pick the one that suits you).

Stretch: if you ever tried Stretching anything, you may have been puzzled by its apparently random action. It's not really a problem, just ambiguous wording. The Stretch command tells you that you must use a window for object selection, but fails to mention that it must be a Crossing Window (which selects all objects that are in it or cross it anywhere). Further, if the objects are enclosed within the window, all you get is the equivalent of Move. Relocate your window so that the objects cross it, and they'll turn into rubber bands for you. Very handy if you've made a complex drawing too narrow — it's much faster than Breaking the objects, Moving, and then splicing in new lines.

Multiple Entries

You can avoid drawing things twice by using the Copy function's *Multiple* feature. This lets you select an object and then mouse around the screen leaving as many copies as you want anywhere you want. This is much faster than a series of Inserts.

There is also the Array function, which can multiply any object into a vertical, horizontal or circular lineup containing any number of identical objects. This one is certainly a powerful tool whenever repetition is needed, such as a row of resistors or other components. It takes a while to get the hang of picking the distance between objects so that the array ends where you want it.

The MINSERT (multiple Insert) command seems less than useful; multiple Copies and Arrays are more flexible.

Text

The text handling of CAD programs falls behind their desktop publishing counterparts; labeling everything can take up half your drawing time. However, there are a few shortcuts. Here's a command for your menu that eliminates typing Returns; it accepts whatever defaults you've set with previous Text commands:

[FASTTXT] ^ CTEXT;;

It works very quickly, and if you want to change Text size, just use the regular Text command to reset defaults. Here's another one that will fit your text between any two points:

[FITTEXT] ^ CTEXT;F;\;

The problem with this one is that the lettering distorts to suit the space available, and your text starts to look a bit messy if you overuse it.

Because of the limitations of most monitors, text will often look quite different when a test print or plot is made. The Change command will let you reset the text size to compensate; just select all the text and Change will step through each occurrence (and you can edit the text while you're at it).

The Text commands are, well, adequate. However, if your drawing is made up mostly of readymade blocks, as schematics would be, the **Attribute** function is where you can really pick up speed.

Attributes

This function lets you predetermine the size and location of the text attached to blocks. It even prompts you with your choice of messages. Just load the block and type in its labels — no mousing, no fiddling with sizes. However, it's not all that well explained in the manual; third-party books do a better job of explaining the rather intricate syntax. Here's a quick introduction to the basic workings.

Suppose you've drawn an NPN transistor for your block library (but haven't defined it as a block just yet). You'd like to have two labels on every transistor in the schematic, the Q number and the manufacturer's type number.

Type ATTDEF. You'll be asked for the following:

Tag is the general name of the attribute, used for reference. You could type *NPN* or similar.

Prompt is the message that will appear when you insert the block. Type *Q number* or similar.

Value is the default label that will appear if you don't type anything in. Type a Return unless you want to enter a default.

When you're finished, type a Return to restart ATTDEF, and add another attribute, this time typing in the same tag name and *Enter part number* or similar.

When you're done, define the transistor and attributes as a block. Try it out with the Insert command. It should draw your NPN and ask you for the part number and Q number.

Attributes are not separate text, but part of the block; you can't Move or Change them as you would other objects. Instead, use ATTEDIT to change the labels or positions (or DDATTE for a dialog box in Versions 9 and 10). ATTDISP will toggle the attributes on or off to speed regeneration.

Next month we'll investigate attributes and layers in more depth, plus more editing tricks, plus reviews of some excellent books on AutoCAD. ■



"I had the education to start working on the world's most powerful proton accelerator right out of DeVry... no working my way up." Jeff Utterback, Fermi National Laboratory, 1986 DeVry Graduate.



"DeVry put my career on the fast track. Three weeks out of school I was already helping to design a multi-user computer system." Lynne Marie Hissong, Illinois Criminal Justice Information Authority, 1987 DeVry Graduate.



"I've worked my way up to the leading edge of business communications. Having DeVry on my resume was my biggest asset." Guy DeCrescenzo, Centel Corporation, 1984 DeVry Graduate.



"My education gave me an advantage... that's why DuPont hired me right out of DeVry. Now I'm hiring DeVry graduates with the same advantage." Roger Sonnabend, E.I. DuPont, 1971 DeVry Graduate.

DeVry graduates are in demand

A DeVry education pays off... and here's proof. Within 120 days of graduation, 93% of DeVry's Canadian graduates were placed in good paying positions, in the fields for which they were trained.*

Major companies in business, computers and electronics across Canada regularly recruit on campus at DeVry.

DeVry Canada teachers bring real-world experience to the classroom. They're professionals who can share their insights into today's business environment. They understand, firsthand, what it takes to succeed. You can't learn that from a textbook.

At DeVry, you learn by doing, in "hands-on" classes, using the latest tools and methods professionals use. And when you graduate, you have what business wants: The ability to apply advanced technology in the marketplace, today and tomorrow.

DeVry Electronics and Computer programmes are accredited in Ontario by the Ontario Association of Certified Engineering Technicians and Technologists (OACETT). In Alberta, our Electronics programmes are accredited by the Alberta Society of Engineering Technologists (ASET).

Good jobs. Good pay. A career with a future. That's what DeVry can mean for you.

Please provide information on DeVry programmes.

☐

Electronics Technology

☐

Computer Information Systems

☐

Business

Name _____

Province _____ Postal Code _____

Address _____

Phone _____ Age _____

City _____

Year of High School Graduation _____

8-9_2E-26

11 Locations in North America.

6-9X2E-26

DeVRY

803 Manning Road N.E.
Calgary, Alberta • T2E 7M8

(403) 235-5400

Avoid postal delays. Call now.

©1989 DeVry Canada, Inc.

We're serious about success®

2201 Finch Avenue West
Weston (Toronto), Ontario M9M 2Z4

(416) 741-9220

Avoid postal delays. Call now.

Find out how you can put your career on the fast track. Fill out the coupon, or call, today.

*1988 graduates in all Day School programmes from DeVry Calgary and Toronto Institutes, who requested placement assistance and actively pursued employment.

THE QUALITY LINE

UNIVERSAL PROGRAMMER for PC/XT/AT

XELTEK UNIPRO

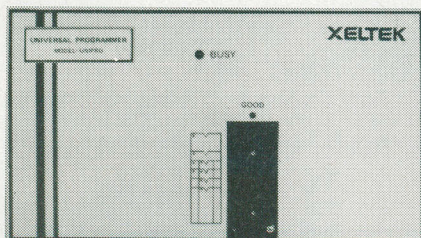
Programs:

- EPROMS (to 1 Mbit)
- Bipolars
- PALs & FPLDs
- 8748/8751

Tests:

- TTL/CMOS Devices
- Memory Devices

Circle No. 70 on Reader Service Card

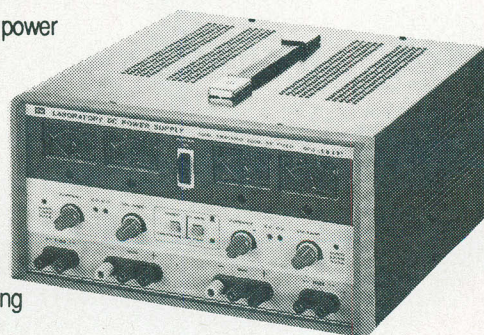


DC POWER SUPPLIES GW INSTRUMENTS — GP SERIES

Over twenty quality power supplies for the lab, classroom or production line.

- Single, Dual or Quad output
- Dual-tracking Volts/Amps. (GPD/GPQ) 0-60V/0-10A
- Analogue metering or Digital display
- Regulation 0.01% typical

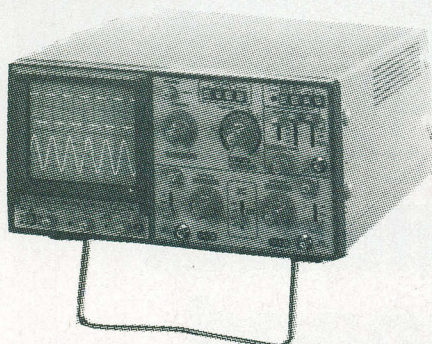
Circle No. 71 on Reader Service Card



DUAL TRACE OSCILLOSCOPES GW INSTRUMENTS — GOS SERIES

For performance and reliability.

- Select from five models.
- Dual or single trace.
- Bandwidth: 40, 20 MHz.
- Triggered/Delayed sweep operation.
- Sensitivity to 1 mV.



Circle No. 71 on Reader Service Card

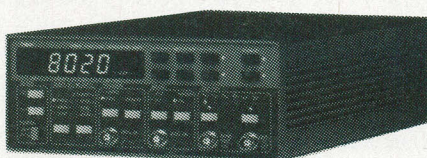
20 MHz FUNCTION GENERATORS TABOR ELECTRONICS — SERIES 8020

Choose from: Model
Standard 8020
Pulse/Function 8021
AM/Function 8022

Product Highlights:

- GPIB - Interface - Field Installable
- 30 Front Panel Set-ups backed by non-volatile memory
- Amplitude 10mV to 30Vp-p
- Frequency 2 mHz to 20 MHz
- Pulse Width 25 nS to 9.99S

Circle No. 73 on Reader Service Card

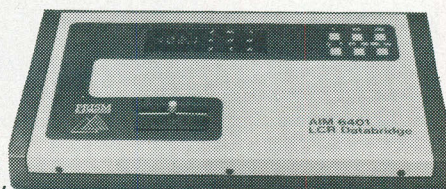


AUTOMATIC LCR BRIDGE PRISM ELECTRONICS — MODEL 6401

Features:

- Measure R, L, C, and Q automatically
- Eight decades of LCR measurement
- Series or parallel measurement modes
- Four digit LED display
- Basic accuracy; 0.25% of reading

Circle No. 72 on Reader Service Card



DIGITAL MULTIMETERS GW INSTRUMENTS — GDM SERIES

Rugged and reliable—for the lab, field or production line.

- Select from four models: 3 1/2 or 4 1/2 digit LED or LCD display
- Standard Functions (AC/DC Volts/Amps & Resistance) plus: Diode check, Continuity Test, Capacitance 1.99 nF to 19.99 uF GDM8034
- Accuracy: to 0.03% (TRMS) GDM8045; to 0.1% DCV GDM8035.

Circle No. 71 on Reader Service Card



GW INSTRUMENTS are available through stocking distributors.

DUNCAN INSTRUMENTS CANADA LTD.

ELECTRONIC INSTRUMENT SPECIALISTS

121 MILVAN DRIVE, WESTON (TORONTO), ONTARIO M9L 1Z8

TELEPHONE: (416) 742-4448 FAX: (416) 749-5053

FLUKE



PHILIPS

Other meters show half the picture

The new Fluke 45 has dual display versatility.

With 2 multifunction displays and 16 different measurement capabilities, the new Fluke 45 does virtually everything you want a meter to do. And for a surprisingly affordable price.



interface and rechargeable batteries are available as options.

Get everything you've ever wanted.
For all the information on the new Fluke 45, contact your local distributor.

The 5-digit, 100,000 count dual displays give you more information in less time — and with less effort. For example, measure the VDC output of a power supply while measuring the VAC ripple. Or check the amplitude and frequency of an AC signal. From a single test connection!

And the Fluke 45 is designed to make complex measurements easier, with standard features like a 1 MHz frequency counter, Min Max, limits testing (Hi/Low/Pass), Touch Hold® and Relative modes. There are 21 different reference impedances for dB measurements; in the 2 Ω to 16 Ω ranges, audio power can be automatically displayed in watts.

Accuracy to get the job done right.

The Fluke 45 is a true-rms meter, with 0.02% basic dc voltage accuracy and 100,000 count resolution on both displays. Basic dc current accuracy is 0.05%, making the 45 ideal for servicing 4-20 mA current loops. Closed-case calibration simplifies the calibration process and increases uptime.

Even an RS-232 interface is standard.

Connecting the Fluke 45 to PCs, RS-232 printers and modems is as easy as attaching the cable. An IEEE-488.2

FLUKE 45 DUAL DISPLAY MULTIMETER

Dual Display	Compare and Relative functions
True-rms voltage and current, including ac + dc	Min Max and Touch Hold® functions
0.02% basic dc voltage accuracy	Optional PC software for RS-232 applications
0.05% basic dc current accuracy	Optional IEEE-488.2 interface, battery pack
1 MHz frequency counter	One year warranty
RS-232 interface standard	
dB, with 21 reference impedances, and audio power calculations	

John Fluke Mfg. Co., Inc. P.O. Box C9090 M/S 250C Everett, WA 98206
U.S.: 206-356-5400 Canada: 416-890-7600 Other Countries: 206-356-5500

© Copyright 1989 John Fluke Mfg. Co., Inc. All rights reserved. IBM PC is a registered trademark of International Business Machines Corporation. Ad No. 1182-F45.

FLUKE

HIGH PLACES



TIGHT SPACES



No matter where you go, Tek's new 222 is a perfect fit.

Introducing Tek's new 222 Digital Oscilloscope. Weighing in at under 4.5 pounds, the new Tek 222 is an ultra-portable, 10-MHz digital storage scope that's perfect for service applications. So tough, rugged, and totally self-contained, it can go just about anywhere. And it's incredibly easy to use—even in extreme conditions.

Extraordinary capability and reliability at a great price. The 222 is a dual-channel scope that can measure a wide variety of electronic instrumentation and circuitry. It has rechargeable on-board batteries with a floating ground to 400 volts, and meets tough environmental standards.

Plus, the 222 lets you pre-define front-panel setups, and call them up with a single button in the field. You can also save waveforms in the scope's memory, then transfer them to a PC for analysis and hard-copy output when you get back to the shop.

Best of all, the 222 is yours for only \$3,354. * And that includes

Tek's remarkable three-year warranty on parts, labor, and CRT.

Get one to go! Pack a handful of power with you wherever you go. To order your 222, or for a free brochure, contact your local Tek representative.



*Canadian Dollars, Tax Additional Subject to Change.

Vancouver
Calgary
Edmonton
Manitoba
Saskatchewan

604-291-1222
403-250-7583
403-434-9466
800-661-5625
800-661-5625

Toronto
Ottawa
Montreal
Dartmouth

416-670-3423
613-225-2850
514-697-5340
902-469-9476

Tektronix
COMMITTED TO EXCELLENCE

Copyright © 1988, Tektronix Inc. All rights reserved.
Prices subject to change without notice.

Circle No. 75 on Reader Service Card

THH-911